

PHARMACOLOGY NOTES

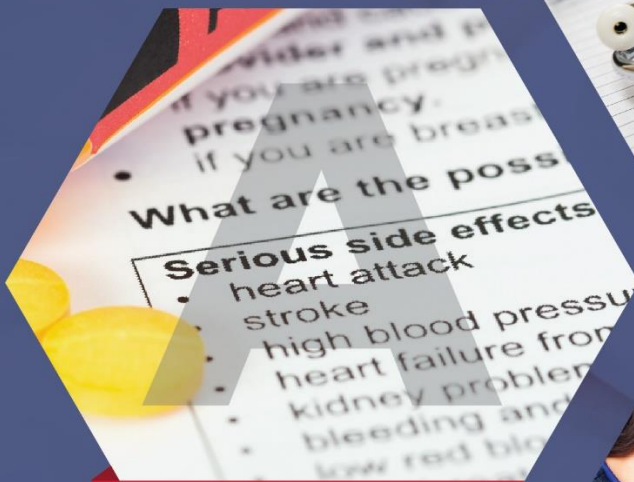
NURSING IMPLICATIONS FOR
CLINICAL PRACTICE



Administration



Therapeutic Effects



Adverse Effects



Teaching

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PHARMACOLOGY NOTES

NURSING IMPLICATIONS FOR CLINICAL PRACTICE

Overview

There are currently nine (9) units comprising this *Pharmacology Notes* resource. Units are broken down by body system and published individually for ease of retrieval:

Unit A: Autonomic Nervous System (ANS) Pharmacology

Unit B: Cardiovascular (CV) System Pharmacology

Unit C: Hematological System Pharmacology

Unit D: Central Nervous System (CNS) Pharmacology

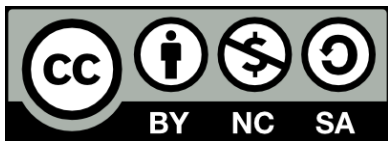
Unit E: Skeletal System: Bone and Joint Pharmacology

Unit F: Immune System Pharmacology

Unit G: Digestive System Pharmacology

Unit H: Endocrine System Pharmacology

Unit I: Respiratory System Pharmacology



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UNIT G

DIGESTIVE SYSTEM PHARMACOLOGY

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 - Pharmacologic Connections for GI Drugs
 - Drug Classes: A-T-A-T

| |
|---|
| (MC) Major Class or Therapeutic Class (SC) Subclass or Pharmacologic Class (SSC) Selective Subclass – more specific action within Subclass |
|---|

- (MC) Antiulcer Agents
- (MC) Antiemetics
- (MC) Prokinetics
- (MC) Laxatives
- (MC) Antidiarrheals
- (MC) Anti-IBD
- (MC) Anti-IBS
- (MC) Miscellaneous GI Drugs
 - (SC) Antiinflammatory
 - (SC) Adsorbents
 - (SC) Antiflatulents
- (MC) Nutritional Aids

Digestive System Pharmacology

I. ANATOMY AND PHYSIOLOGY/PATHOPHYSIOLOGY REVIEW

A. Anatomic Divisions: GI Structures and Functions

1. Gastrointestinal (GI) Tract or Alimentary Canal:
 - a. Upper GI tract structures and functions:
 - 1) mouth – food entry/processing
 - 2) esophagus – food passage
 - 3) stomach – breaking down food → chemical digestion:
 - a) chief cells – pepsinogen → pepsin
 - b) parietal cells – hydrochloric acid, intrinsic factor
 - b. Lower GI tract structures and functions:
 - 1) small intestine – absorption of nutrients
 - 2) large intestine – elimination of wastes
2. Accessory Organs of Digestion:
 - a. Salivary glands
 - b. Liver
 - c. Gall bladder
 - d. Pancreas

B. Factors Affecting Digestion

1. Enzymes
2. Peristalsis – speed
3. Enteric Nervous System (part of ANS) – regulates digestive tract motility, secretion and blood flow
4. Mucosa Layer = inner lining of GI tract:
 - a. Mucous cells secrete **mucous** to protect stomach lining; keeps stomach from digesting itself
 - b. Bicarbonate ion to **neutralize** acid

C. Common GI Disorders

1. Peptic Ulcer Diseases (PUD):
 - a. Description: erosion of mucosa layer of GI tract associated with acute inflammation (e.g. gastric or duodenal ulcers)
 - b. Causes:
 - 1) helicobacter pylori infection*
 - 2) excessive acid secretion
 - 3) hyposecretion of adequate mucous protection
 - c. Risk factors:
 - 1) other drugs (e.g. NSAID's, corticosteroids)
 - 2) stress

- 3) smoking
 - 4) caffeine
 - 5) blood type O
 - 6) family hx
 - d. Consequences/Complications:
 - 1) acute GI bleed/hemorrhage
 - 2) anemia
2. Gastroesophageal Reflux Disease (GERD):
- a. Description: acid contents of stomach move upward into esophagus
 - b. Causes: weakening of lower esophageal sphincter (no longer closes tightly)
 - c. Risk factors:
 - 1) obesity
 - 2) eating large meals or fatty or acid foods
 - 3) tobacco or alcohol use
 - 4) age >40 and infants
 - d. Consequences/Complications:
 - 1) esophagitis
 - 2) esophageal ulcers or strictures
3. Inflammatory Bowel Disease (IBD):
- a. Cause: chronic inflammation of small and/or large intestines; idiopathic with possible autoimmune origin
 - b. Types:
 - 1) Crohn's Disease
 - 2) Ulcerative colitis
 - c. Risk factors:
 - 1) genetic predisposition
 - 2) possible dietary influences (promoting microbial overgrowth)
 - 3) stress
 - d. Consequences/Complications:
 - 1) GI ulcers/bleeding
 - 2) ↑ risk of colorectal cancer
 - 3) formation of GI fistulas, strictures and abscesses
 - 4) malnutrition
4. Irritable Bowel Syndrome (IBS):
- a. Cause: unknown/unclear
 - b. Risk factors:
 - 1) intestinal infections
 - 2) stress
 - 3) dietary factors
 - c. Consequences/Complications:
 - 1) altered bowel elimination (alternating constipation or diarrhea)
 - 2) nutritional imbalances

5. Constipation:
 - a. Description: ↓ frequency or number and/or amount of stool/bowel movements (BMs)
 - b. Causes:
 - 1) lack of exercise/activity
 - 2) insufficient food intake
 - 3) ↓ fluid intake
 - 4) adverse effects of medications (e.g. opioids, anticholinergics, antihistamines, antacids, iron)
 - c. Risk factors:
 - 1) age
 - 2) chronic illnesses
 - 3) lifestyle
 - d. Consequences/Complications:
 - 1) overall discomfort
 - 2) fecal impaction → bowel obstruction
 - 3) straining with defecation → Valsalva maneuver with vagal response
6. Diarrhea:
 - a. Description: ↑ frequency and fluidity of bowel movement (BMs)
 - b. Cause: ↓ reabsorption of water from fecal matter in large intestine
 - c. Risk factors:
 - 1) adverse effects of medications (e.g. antibiotics)
 - 2) bowel infections
 - 3) chronic inflammatory bowel conditions (i.e. Crohn's Disease, ulcerative colitis)
 - 4) irritable bowel syndrome
 - d. Consequences/Complications:
 - 1) fluid loss
 - 2) electrolyte imbalances
 - 3) acid-base imbalances
7. Nausea:
 - a. Description: unpleasant subjective sensation accompanied by weakness, diaphoresis, hyper-production of saliva
 - b. Cause: stimulation of vomiting center:
 - 1) digestive tract via vagus nerve → involve **serotonin** and **dopamine**
 - 2) inner ear (vestibular apparatus) → involve **histamine**, and **muscarinic** receptors
 - 3) chemoreceptor trigger zone (CTZ) in cerebral cortex → involve **serotonin**, **dopamine**, and **muscarinic**
 - c. Risk factors:
 - 1) GI infections/GI trauma
 - 2) food poisoning
 - 3) stress
 - 4) motion sickness

- 5) extreme pain
- 6) pregnancy
- 7) other medications (adverse effects)
- d. Consequences/Complications = vomiting/emesis:
 - 1) fluid loss
 - 2) electrolyte imbalances
 - 3) acid-base imbalances

II. PHARMACOLOGY

A. Pharmacological Connections for GI Drugs

1. When managing GI Disorders, often agents are given to ***treat/prevent***.
 - a. **Cause:** e.g. PUD → infection (h. pylori)
 - b. **Effect** = s/sx of GI upset or distress:
 - e.g.
 - 1) abdominal pain
 - 2) indigestion/heartburn
 - 3) nausea/vomiting
 - 4) anorexia/weight loss
 - 5) bowel irregularity (constipation/diarrhea)
 - c. **Complications:**
 - e.g.
 - 1) GI inflammation or bleeding ulcers
 - 2) fluid and electrolyte imbalances
 - 3) nutritional deficiencies/malnutrition
 - 4) fecal impaction → bowel obstruction
2. **Goals** of Drug Therapy:
 - a. Eliminate cause(s) if possible
 - b. Reduce or eliminate GI upset or distress
 - c. Prevent consequences/complications:
 - 1) maintain weight
 - 2) maintain or restore normal fluid and electrolyte balance
 - 3) prevent acute GI bleeding

Nursing Implications: GI Pharmacology: Antiulcer Agents

| Subclass | MOA | Prototype – generic | Prototype – trade | A – Admin | T – ✓ Therapeutic Effects – General (MC) | A – ✓ Adverse Effects – Specific (SC) | T – Teaching – General (MC) | T – Teaching – Specific (SC) |
|--|--|---|-------------------------------------|---|---|---|--|--|
| histamine ₂ receptor antagonist/ blockers (H ₂ RB) | Blocks histamine ₂ -receptors in stomach leading to ↓ acid production (suppresses volume & acidity of parietal cell secretions) | rantidine famotidine cimetidine | Zantac Pepcid Tagamet | Timing: pc/ HS | ↓ s/sx PUD/GERD: <ul style="list-style-type: none"> • ↓ abdominal pain • ↓ heartburn - • Ø c/o N/V Ø s/sx GI bleed: <ul style="list-style-type: none"> • (-) stool guaiac • Ø blood in emesis or stool • improved blood counts: <ul style="list-style-type: none"> ○ ↑ RBCs ○ ↑ Hgb ○ ↑ Hct | <ul style="list-style-type: none"> • GI: D/C • CNS: drowsiness, dizziness; confusion, restlessness, hallucinations, depression • Heme: ↓ B₁₂ absorption | <ul style="list-style-type: none"> • Take as directed • Diet: Ø foods that ↑ gastric acid secretion • Ø smoking or drinking • HOB ↑ for reflux • Report s/sx GI bleed | <ul style="list-style-type: none"> • ✓ CBC, liver & renal fn tests • Ø antacids • Report: fever, excessive bruising |
| proton pump inhibitor (PPI) | Blocks (H ⁺ , K ⁺ -ATPase) enzyme responsible for secreting hydrochloric acid leading to ↓ acid production (enzyme acts as 'pump' to release acid) | omeprazole pantoprazole | Prilosec Protonix | Timing: ac | | <ul style="list-style-type: none"> • GI: N/V/D/ abd. pain • Other: rash, HA If used long-term: risk of gastric cancer | | <ul style="list-style-type: none"> • Short-term use • ✓ liver fn tests if taken long-term • Contraception |
| antacids | Alkaline, inorganic substance that neutralizes stomach acid by raising pH (Does not promote healing of ulcer – nor eradicate h. pylori) | aluminum hydroxide calcium carbonate sodium bicarbonate | AlternaGel, Amphojel Tums | Timing: Do <u>not</u> give within 2 hrs of other meds; ac | | <ul style="list-style-type: none"> • GI: N/V/C/D, abd. cramping, distention, belching • Electrolyte imbalances depending on compound used (i.e. aluminum, Mg⁺⁺, Ca⁺⁺, Na⁺) | | <ul style="list-style-type: none"> • ✓ renal function tests; electrolytes • Do <u>not</u> take w/ other meds – space by 2 hrs |
| mucosal protectants | Produces thick, gel-like substance that coats ulcer, protecting from further erosion/ promoting healing; (does not ↑ gastric acid secretion nor eradicate h. pylori) | sucralfate | Carafate | Timing: ac & HS; space 1-2 hr of other meds | | <ul style="list-style-type: none"> • GI: constipation, dry mouth | | <ul style="list-style-type: none"> • Do <u>not</u> take 1-2 hrs of other meds |

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|-----------------------------------|---|---------------------|-------------------|---------------------------------------|--|---|-----------------------------|---|
| prostaglandin E analogs | Inhibits gastric acid secretions & stimulates production of protective mucous | misoprostol | Cytotec | With meals & HS | | <ul style="list-style-type: none"> GI: diarrhea, abd. cramping | | <ul style="list-style-type: none"> Contraception |
| Other meds: antiinfectives | #1 drug to treat PUD – Irradiates h. pylori organism | metronidazole | Flagyl | Refer to Antiinfective lecture | | | | |
| | | clarithromycin | Biacin | | | | | |
| | | amoxicillin | Amoxil | | | | | |

Nursing Implications: GI Pharmacology: Antiemetics/Prokinetics

| Subclass | MOA | Prototype – generic | Prototype – trade | A – Admin | T – ✓ Therapeutic Effects – General (MC) | A – ✓ Adverse Effects – Specific (SC) | T – Teaching – General (MC) | T – Teaching – Specific (SC) |
|--|--|--|---|---|---|---|---|---|
| anticholinergics | Blocks action of <i>acetylcholine</i> → blocks impulses from vestibular apparatus of inner ear to vomiting center | scopolamine | Transderm Scop | Can use > 1 antiemetic – selection based on emetogenic risk Route: • dependent on nausea vs. vomiting • PO route discouraged w/ active vomiting | • ↓s/sx N/V • Ø complications 2° N/V: dehydration, electrolyte imbalances | ALL Antiemetics: CNS depression • Dry mouth, drowsiness, urinary retention, constipation | • Safety , ↓ activity • Timing of meds – take before N/V • Diet : NPO during acute vomiting; advance as tolerated • Avoid other CNS depressants; • ✓ labs 2° N/V | Related to managing adverse effects • Good oral care • Give fluids & fiber |
| antihistamines | Blocks <i>histamine</i> ₁ & muscarinic receptors between inner ear & vomiting center | dimenhydrinate meclizine hydroxyzine | Dramamine Antivert Atarax, Vistaril | | | • Dry mouth, drowsiness, urinary retention, constipation | | • Good oral care • Give fluids & fiber |
| phenothiazines/ dopamine antagonists | Blocks <i>dopamine</i> receptors in brain → block signals to vomiting center | prochlorperazine metoclopramide | Compazine Reglan | | | • CV : hypotension (orthostatic), tachycardia • EPS (dyskinesia, dystonia akathisia, Parkinsonism) | | • ✓ EPS • ✓ BP |
| serotonin antagonists/ SSRIs | Block <i>serotonin</i> receptors in CTZ; & vagal neurons traveling from UGI tract to CTZ | ondansetron | Zofran | | | • GI : diarrhea/ constipation • Other: dizziness, HA, fatigue | | • Monitor bowel function |
| cannabinoids | Same active ingredient as marijuana; produces both antiemetic & relaxation effects – mechanism unknown | dronabinol nabilone | Marinol Cesamet | | | • Altered mood, cognition, perception, conjunctivitis; potential for abuse | | • Watch for habit forming |
| Substance P/ neurokinin 1 antagonist (SPA) | Inhibits substance P in brain (vomiting center in medulla contains high conc. of substance P; their activation stimulates vomiting reflex) | aprepitant | Emend | | | • Fatigue, diarrhea, dizziness, hepatotoxicity | | • ✓ liver enzymes |

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| Others (FYI): benzodiazepine corticosteroids | | lorazepam | Ativan | Refer to Neuro and Endocrine Pharmacology | | | | |
| MAJOR CLASS: PROKINETIC/ GI stimulants | TWO (2) MOAs: 1. blocks <i>dopamine</i> & serotonin receptors in CTZ; 2. parasympathomimetic – mimics actions of <i>Ach</i> → <i>cholinergic</i> | metoclopramide | Reglan | (See previous page) | <ul style="list-style-type: none"> • ↓ N/V & other complications • ↓s/sx of GERD • Improved GI function – +BS, +BM | <ul style="list-style-type: none"> • GI: diarrhea • + EPS; CNS depression/sedation | <ul style="list-style-type: none"> • Similar w/ other antiemetics – watch use of other ANS drugs | <ul style="list-style-type: none"> • ✓ bowel fn • ✓ EPS |

Nursing Implications: GI Pharmacology: Laxatives

| Subclass | MOA | Prototype – generic | Prototype – trade | A – Admin | T – ✓ Therapeutic Effects – General (MC) | A – ✓ Adverse Effects – General (MC) | A – ✓ Adverse Effects – Specific (SC) | T – Teaching – General (MC) | T – Teaching – Specific (SC) |
|--|--|---|---------------------------------|--|---|---|---|---|--|
| Bulk-forming/mechanical stimulants (can also be used for diarrhea) | Absorbs water → add size to fecal mass → ↑ defecation reflex r/t bowel wall stretching | psyllium muciloid | Metamucil | Route: PO Mix w/ 8 oz of water – give <u>immediately</u> | ↓ s/sx constipation: <ul style="list-style-type: none"> + BM soft-formed stools no abd pain or fullness or distention Ø complications assoc. w/ constipation: <ul style="list-style-type: none"> no straining (Valsalva maneuver) | • GI: diarrhea, abd cramping, nausea | <ul style="list-style-type: none"> Aspiration, esophageal obstruction due to thickened drink | <ul style="list-style-type: none"> Take as directed – no overuse Hold for diarrhea Diet: high fiber, fluids Activity as tolerated NOTE: laxatives may interfere w/ absorption of other meds | <ul style="list-style-type: none"> Mix well – drink promptly Aspiration precaution as indicated |
| stool softener/surfactant/lubricants | ↑absorption of water & fat in stools → aids in easier stool passage by serving as a 'wetting agent' (lowers surface tension) | docusate sodium | Colace | Route: PO Freq: Take daily | | | | | |
| stimulant (chemical) | Irritates bowel to increase peristalsis by directing & stimulating nerve plexus in intestinal wall | bisacodyl senna tabs (herbal agent) | Dulcolax Senakot, Ex-Lax | Route: PO – Don't chew; if given pr – insert finger length | | | <ul style="list-style-type: none"> Laxative dependency | | <ul style="list-style-type: none"> Contraception Do <u>not</u> take w/ milk or antacids |
| osmotics | Not absorbed in intestine; pulls water into fecal mass to create more watery stool | polyethylene glycol magnesium hydroxide lactulose | Milk of Magnesia Miralax | Route: PO Timing: Give on empty stomach | | | <ul style="list-style-type: none"> Electrolyte imbalances, esp. Mg++ Dehydration or fluid retention Used as an ammonium detoxicant | | <ul style="list-style-type: none"> Monitor labs as indicated, esp. w/ h/o renal & liver dz Increase fluids Safety during bowel cleansing prep |

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|-------------------------|---------------------------------|---------------------|-------------------|---|--|--------------------------------------|--|-----------------------------|---|
| Miscellaneous laxatives | Lubricates stool & colon mucosa | mineral oil | | Route: PO Do <u>not</u> give w/ other meds or vitamins | (See previous page) | (See previous page) | <ul style="list-style-type: none"> Interferes w/ absorption of fat-soluble vitamins | (See previous page) | <ul style="list-style-type: none"> Discourage use of mineral oil for treating constipation Do <u>not</u> take w/ other meds or vitamins |

Nursing Implications: GI Pharmacology: Antidiarrheals & Miscellaneous GI Drugs

| Major Class/ Subclass | MOA | Prototype – generic | Prototype – trade | A – Admin | T – ✓ Therapeutic Effects – General (MC) | A – ✓ Adverse Effects – Specific (SC) | T – Teaching – General (MC) |
|--------------------------------------|--|---|--|---|---|--|--|
| Antidiarrheal: Opioid | Acts directly on intestine to slow peristalsis → ↑ absorption of fluids & electrolytes | diphenoxylate w/ atropine loperamide | Lomotil Imodium | Route: PO Schedule V | <ul style="list-style-type: none"> • ↓# of BMs • ↓abd. pain, cramping • ↑formed stools | <ul style="list-style-type: none"> • GI: constipation • CNS: dizziness, drowsiness • Other: anticholinergic effects | <ul style="list-style-type: none"> • Take as directed – short term use • Encourage fluids • Report worsening GI sx • Safety • Avoid CNS depressants • Labs: lytes, renal, liver function tests |
| Anti-IBD: NSAIDs – Step 1 | ↓ inflammation by inhibiting prostaglandin synthesis | sulfasalazine | Azulfidine | Route: PO • Consider contraindications of NSAIDs | <ul style="list-style-type: none"> • ↓inflammation → • ↓# of BMs & • ↓abd pain, cramping | <ul style="list-style-type: none"> • GI: N/V/D, dyspepsia, abd pain • Blood: dyscrasias • Other: hepatotoxicity | <ul style="list-style-type: none"> • Take as directed • Report worsening GI sx • Labs: CBC, liver enzymes • DDIs |
| Anti-IBD: Corticosteroids – Step 2 | ↓ inflammation by increasing cortisol | prednisone budesonide | Deltasone Entocort – EC, Uceris | Refer to Endocrine Pharmacology | | | |
| Anti-IBD: Immunosuppressant – Step 3 | Suppresses immune response | azathioprine methotrexate | Imuran MTX, Rheumatrex, Trexall | Refer to Immune Pharmacology | | | |
| Anti-IBS: Diarrhea form | Blocks serotonin receptors in colon → relaxes colon to slow movement → ↓ urgency/freq of BMs | al osetron ("loose stools") | Lotronex (name similar to Lomotil → antidiarrheal) | Route: PO | <ul style="list-style-type: none"> • ↓# of BMs • ↓ urgency/freq of stools | <ul style="list-style-type: none"> • GI: constipation • GI toxicity: ischemic colitis, bowel obstruction, impaction or perforation | <ul style="list-style-type: none"> • Take as directed • Report worsening GI sx • Diet: limit/eliminate caffeine, alcohol, milk products, high sugar, fatty food, gas-producing, artificial sweeteners • Stress mgmt. |

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|--------------------------------|---|--|----------------------|---|--|--|---|
| Anti-IBS: Constipation form | ↑ fluid secretion in intestine to promote motility | lub iprostone ("lubricate" bowel) | Amitiza | Route: PO w/ food | <ul style="list-style-type: none"> • Relief of constipation • Return of normal bowel function | <ul style="list-style-type: none"> • GI: N/diarrhea; abd. pain | <ul style="list-style-type: none"> • Take as directed w/ food • Report worsening GI sx • Diet: add fiber, water, exercise • Stress mgmt. • Support groups |
| Antiinflammatory/ Antacid | ↓ inflammation & acts as antacid | bismuth subsalicylate | Pepto-Bismol | Route: PO – liquid, tablets | <ul style="list-style-type: none"> • ↓ inflammation → <ul style="list-style-type: none"> ○ ↓ # of BMs & ○ ↓ abd pain, cramping | <ul style="list-style-type: none"> • GI: blacken stools & tongue • Salicylism: long-term use | <ul style="list-style-type: none"> • Take as directed • Report worsening GI sx • Do <u>not</u> give to children |
| Adsorbents | Preferred method for removing ingested poisons from the GI tract by adhering to drug molecules :→ prevents their absorption into the blood → eliminates in stools | charcoal tablets | | Route: PO (fine powder consistency) Adults: 60-100 gm Children: 15-30 gm Contraindications: bowel perforation or obstruction | <ul style="list-style-type: none"> • ↓ Poison absorption & toxicity | <ul style="list-style-type: none"> • GI: ↑ BMs | <ul style="list-style-type: none"> • Mix w/ water for oral administration • Administer within 30 minutes after poison ingestion (best results) • Do <u>not</u> give antidote immediately before, with, or shortly after the charcoal |
| Antiflatulents | ↓ gas bubbles → allows easier passing of flatulence (antifoaming agent) | simethicone | Mylicon, Gas-X | Route: PO | <ul style="list-style-type: none"> • Relief of bloating & abdominal discomfort | <ul style="list-style-type: none"> • GI: minimal as it is not absorbed in body; mild N/V/D | <ul style="list-style-type: none"> • Take as directed w/ food • Report worsening GI sx |

Nursing Implications: GI Pharmacology: Nutritional Aids

| Major Class | MOA | Prototype – generic | Prototype – trade | A – Admin | T – ✓ Therapeutic Effects – General (MC) | A – ✓ Adverse Effects – Specific (SC) | T – Teaching – GENERAL (MC) |
|-------------------|---|--|---------------------------|---|--|---|---|
| Digestive enzymes | Pancreatic enzymes | pancrelipase [lipase, alpha-galactosidase] | Creon, Viokase, Pancrease | Route: PO – capsule (delayed release), powder, tablet Should be taken w/ each meal & snack | Improvement in nutritional markers – esp. fat digestion • ↓ fatty stools | • GI: N/V/D • F& E: hyperuricemia (high doses) | • DDI: iron, antacids • ✓ uric acid levels • Use w/ caution in DM: ✓ BG |
| Probiotics | Nonherbal dietary – maintains intestinal health (lactobacilli – normal components of gut flora) | lactobacillus acidophilus | | Route: PO – daily | • Improvement in food metabolism; promote nutrient absorption • Reduce diarrhea caused by clostridium difficile (c. diff colitis) | • GI: flatulence, bloating (generally well-tolerated) if taken in recommended doses | • Maintain balanced diet |