Gastrointestinal Drugs

Subcommittee:

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Recommended Curriculum Equivalent: 1.5 h

Acid Reducers and Drugs for the Treatment of Peptic Ulcer Disease	
Proton pump inhibitors	
First generation	Second generation
OMEPRAZOLE	ESOMEPRAZOLE LANSOPRAZOLE PANTOPRAZOLE RABEPRAZOLE
Learning Objectives	
Physiology and pathophysiology Describe the synthesis and mechanism of H^+ secretion by the parietal cells	
Mechanism of action Describe the mechanism of action of proton pump inhibitors and why they are selective for the parietal cell proton pump.	
Actions on organ systems Describe the pharmacological effects of the drugs on gastric function. Are there effects on other organ systems?	
Pharmacokinetics Describe the pharmacokinetics of proton pump inhibitors? Are there significant differences among the different drugs in this class?	
Adverse effects, drug interactions and contraindications Describe the principal adverse effects of proton pump inhibitors. Describe the clinically important drug interactions of proton pump inhibitors. Describe the principal contraindications of proton pump inhibitors.	
Therapeutic uses Describe the current therapeutic uses of proton pump inhibitors.	

Clinical Pharmacology

Omeprazole is perceived to be the most potent of this drug class in inhibiting CYP2C19 activity and is proposed to have potential drug interactions with other drugs metabolized by this P450 isoform. Concern has been raised about potential inhibition of clopidogrel activation in patients taking both drugs concurrently. Current consensus is that in such patients clopidogrel with pantoprazole may be a safer choice to reduce the probability of a drug interaction involving CYP2C19.

Prolonged used of PPI drugs is associated with hypomagnesemia. This possibility is a concern in debilitated patients especially in those having underlying cardiac arrhythmias and/or oesteoporosis where associated muscle weakness might increase risk of a fall and subsequent fracture.

Relevance	
USMLE topic **Gastrointestinal System, Normal Processes –** organ structure and function including digestion; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal secretory products	**Principles of therapeutics** Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; treatment and prophylaxis of peptic ulcer disease and gastroesophageal reflux
AAMC Medical School Objectives Project Report X Patient Safety-Table 1	**Topic C—**Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease

Acid Reducers and Drugs for the Treatment of Peptic Ulcer Disease		
Endogenous Substance	H_2 Receptor Antagonists	
	First Generation	Second Generation
histamine	cimetidine	FAMOTIDINE NIZATIDINE RANITIDINE

Learning Objectives

Physiology and pathophysiology
Describe the neurohumoral control of H^+ secretion by gastric parietal cells.
Describe the role of histamine in the different phases H^+ secretion.
Describe the causes of H^+ hypersecretion.

Mechanism of action
Explain the molecular mechanism of action H_2 receptor antagonists.

Actions on organ systems
Describe the pharmacological effects of the drugs on the stomach.
Do these anatagonists have effects on other organ systems?

Pharmacokinetics
Describe the pharmacokinetics of the H_2 receptor antagonists.

Adverse effects, drug interactions and contraindications
Describe the principal adverse effects of each H_2 receptor antagonist.
Describe the clinically important drug interactions of H_2 receptor antagonists.
Describe the principal contraindications of H_2 receptor antagonists.

Therapeutic uses
Identify current therapetutic uses of H_2 receptor antagonists.

Clinical Pharmacology
Tolerance and loss of efficacy occurs with prolonged use of drugs in this class. Due to its ability to inhibit activity of many CYP isoforms, cimetidine is not the preferred drug in this class when administered concurrently with other drugs whose elimination is cytochromes P450-dependent. Use of ranitidine or famotidine is considered preferable in such patients.

Relevance

USMLE topic	Principles of therapeutics
Gastrointestinal System, Normal Processes – organ structure and function including digestion; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal secretory products **Abnormal Processes –** idiopathic disorders	Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; treatment and prophylaxis of peptic ulcer disease and gastroesophageal reflux

AAMC Medical School Objectives Project Report X Patient Safety-Table 1	**Topic C—**Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease
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Acid Reducers and Drugs for the Treatment of Peptic Ulcer Disease		
Acid Neutralizers (Classic Antacid preparations)		
Endogenous substance	Single agent	Mixed preparations
H^+	ALUMINUM HYDROXIDE CALCIUM CARBONATE MAGNESIUM HYDROXIDE sodium bicarbonate	ALUMINUM HYDROXIDE MAGNESIUM HYDROXIDE/
Learning Objectives		
Physiology and Pathophysiology Describe the mechanisms of H^+ secretion in the stomach		
Mechanism of action Describe the mechanism of action of antacid medications. Describe the differences in onset and duration of action of each antacid preparation.		
Actions on organ systems Describe the pharmacological effects of the drugs in each class on the stomach.		
Pharmacokinetics Describe the absorption and systemic actions of antacid preparations		
Adverse effects, drug interactions and contraindications Describe the principal adverse effects of each antacid preparation. Describe the clinically important drug interactions with antacids. Describe the principal precautions and contraindications in the use of antacids.		
Therapeutic uses Describe the primary indication of antacid use.		
Clinical Pharmacology The main concern with these antacids is chelation of co-administered drugs that may be interpreted as disease progression due to reduction of systemic bioavailability of these other agents. Some older patients ingest calcium carbonate tablets as a cheap source of calcium supplementation as a means to preserve bone mass. There is no good evidence to support the claim that long-term use of antacids prevents to occurrence of peptic ulcers.		
Relevance		

USMLE topic **Gastrointestinal System, Normal Processes –** organ structure and function including digestion; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal secretory products **Abnormal Processes –** idiopathic disorders	**Principles of therapeutics** Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; treatment and prophylaxis of peptic ulcer disease and gastroesophageal reflux
AAMC Medical School Objectives **Project Report X Patient Safety-**Table 1	**Topic C** Drug treatment of less common but severe conditions
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Drugs for the Treatment of Peptic Ulcer Disease		
Cytoprotectant agents		
Endogenous substance	Analog	Surface protectant
PGE_2	MISOPROSTOL	SUCRALFATE
Learning Objectives		
Physiology and Pathophysiology Describe the mechanisms for production of the gastric cytoprotective barrier. Describe causes for disruption of the cytoprotective barrier.		
Mechanism of action Explain the mechanism of action of each drug.		
Actions on organ systems Describe the pharmacological effect of the each drug on the cytoprotective barrier.		
Pharmacokinetics Describe the absorption, distribution metabolism and excretion of each drug.		
Adverse effects, drug interactions and contraindications Describe the principal adverse effects of each drug. Describe clinically important drug interactions of the drugs in each class.		
Therapeutic uses Describe the primary indications for use of each drug.		
Clinical Pharmacology As a prostaglandin analog, misoprostol is contraindicated in pregnancy. Its dose-related GI toxicity has relegated its use to second-line strategy. In patients with renal impairment, hypophosphatemia and aluminum intoxication become a concern with prolonged use of sucralfate.		
Relevance		

USMLE topic **Gastrointestinal System, Normal** **Processes –** organ structure and function including digestion; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal secretory products; gastrointestinal defense mechanisms **Abnormal Processes –** drug-induced adverse effects on the gastrointestinal system	**Principles of therapeutics** Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; treatment of peptic ulcer disease
AAMC Medical School Objectives Project Report X Patient Safety-Table 1	**Topic C** Drug treatment of less common but severe conditions
Notes	

<table>
<tr><th colspan="5">Drugs for the Treatment of Peptic Ulcer Disease</th></tr>
<tr><th colspan="5">Helicobacter pylori eradication</th></tr>
<tr><td colspan="2">Triple therapy</td><td colspan="3">Quadruple therapy</td></tr>
<tr><td>Antibiotics</td><td>Acid suppression</td><td>Antibiotics</td><td>Acid suppression</td><td>other</td></tr>
<tr><td>AMOXICILLIN
CLARITHROMYCIN
METRONIDAZOLE
TETRACYLCINES</td><td>PPI</td><td>CLARITHROMYCIN
TETRACYLCINES</td><td>H_2-BLOCKERS
PPI</td><td>BISMUTH SUBSALICYLATE</td></tr>
<tr><td colspan="5">Physiology and Pathophysiology:
Describe the role of H. pylori in peptic ulcer disease.
Describe tests for evaluating H. pylori infection.</td></tr>
<tr><td colspan="5">Therapeutic uses:
Describe the use of triple and quadruple therapy regimens used for H. pylori eradication.
Describe factors to be used in selecting the best therapeutic options for a given patient.</td></tr>
<tr><td colspan="5">Mechanism of action:
Describe the contribution of each agent in triple or quadruple therapy regimens in H. pylori eradication.</td></tr>
<tr><td colspan="5">Drug interactions
Describe potential drug interactions.
Describe potential for antibiotic resistant strains of H. pylori.</td></tr>
<tr><td colspan="5">Clinical Pharmacology
Amoxicillin, clarithromycin and a PPI is the most commonly recommended triple therapy regimen. With initial treatment failure, bismuth subsalicylate is often added to the second attempt at eradication and the approach is then referred to as quadruple therapy. Bismuth subsalicylate ingestion has been associated with salicylate intoxication, especially in children, and in adults ingesting other salicylate-containing drug preparations concurrently.</td></tr>
<tr><th colspan="5">Relevance</th></tr>
<tr><td colspan="3">USMLE topic
Gastrointestinal System, Normal Processes – organ structure and function including digestion; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal secretory products
Abnormal Processes – infectious disorders</td><td colspan="2">Principles of therapeutics
Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; treatment and prophylaxis of peptic ulcer disease</td></tr>
<tr><td colspan="3">AAMC Medical School Objectives Project Report X Patient Safety-Table 1</td><td colspan="2">Topic C
Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease</td></tr>
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<table>
<tr><th colspan="3">Prokinetic Drugs and Laxatives</th></tr>
<tr><td colspan="3">Recommended Curriculum Equivalent: 1 hr</td></tr>
<tr><td colspan="3">Drug Classes and Drugs to consider</td></tr>
<tr><td>Drugs used to treat upper GI motility disorders (Gastroparesis, dyspepsia, GERD)</td><td colspan="2">Drugs used to treat lower GI motility disorders (Constipation)</td></tr>
<tr><td rowspan="2">METOCLOPRAMIDE
cisapride
domperidone
erythromycin
tegaserod</td><td>Receptor mediated</td><td>Laxatives</td></tr>
<tr><td>ALVIMOPAN
LUBIPROSTONE
METHYLNALTREXONE
bethanechol
neostigmine
renzapride
tegaserod</td><td>DOCUSATE
LACTULOSE
METHYLCELLULOSE
POLYETHYLENE GLYCOL
SODIUM PHOSPATE
SODIUM CITRATE
PSYLIUM
castor oil, bisacodyl, senna, cascara, mineral oil</td></tr>
<tr><td colspan="3">Learning Objectives</td></tr>
<tr><td colspan="3">Physiology and Pathophysiology
Describe the neural and hormonal mechanisms controlling stomach and intestinal motility
Describe the changes in neural and hormonal control of stomach and intestinal motility that lead to delayed gastric emptying or accommodation.</td></tr>
<tr><td colspan="3">Mechanisms of action
Explain the molecular mechanism of action of each drug.</td></tr>
<tr><td colspan="3">Actions on organ systems
Describe why some drugs are selective for upper GI motility disorders and why others are selective for lower GI motility disorders.</td></tr>
<tr><td colspan="3">Pharmacokinetics
Describe the relevant pharmacokinetic features of each drug</td></tr>
<tr><td colspan="3">Adverse effects, drug interactions and contraindications
Describe the principal adverse effects of the drugs of each class.
Describe the clinically important drug interactions of the drugs of each class
Describe the principal contraindications of the drugs of each class</td></tr>
<tr><td colspan="3">Therapeutic uses
Outline the main therapeutic uses of the drugs of each class.</td></tr>
</table>

Clinical Pharmacology

Cisapride is no longer favored because of its potent inhibition of CYP3A, the cytochrome P450 isoform responsible for metabolism of a large proportion of drugs ingested by patients, and the fact that it is associated with prolongation of the QTc interval.

Drugs to treat constipation are frequently abused by the general population. Use should be progressive from stool softeners (ducosate) to fibre supplementation (methylcellulose) and finally to propulsive agents. Recently polyelectrolyte lavage solution has been found to be acceptable with less cramping than seen with the use of castor oil.

Relevance

USMLE topic	**Principles of therapeutics**
Laxatives: Gastrointestinal System, Normal Processes – organ structure and function including motility, digestion and absorption; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal defense mechanisms and normal flora **Abnormal Processes –** infection, inflammatory and immunologic disorders**;** systemic disorders affecting the gastrointestinal system; drug-induced adverse effects on the gastrointestinal system; idiopathic disorders **Prokinetics: Gastrointestinal System, Normal Processes –** organ structure and function including motility; cell/tissue structure & function including endocrine and neural regulatory functions **Abnormal Processes –** systemic disorders affecting the gastrointestinal system; idiopathic disorders	**Laxatives:** mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; drugs to alter gastrointestinal motility **Prokinetics:** mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; drugs to alter gastrointestinal motility; treatment and prophylaxis of gastroesophageal reflux
AAMC Medical School Objectives **Project Report X Patient Safety**-Table 1	**Topic C** Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease

Notes

Cisapride is available in the U.S. only in special cases.

Tegaserod has been removed from the U.S. market and is now available only in emergency cases requiring special FDA approval.

Domperidone is available in Europe and Canada but not the U.S. However, patients in the U.S. have access to this drug via the internet or by travel to Europe and Canada.

Anti-diarrheal drugs

Recommended Curriculum Equivalent: 0.5 hr

Drug Classes and Drugs to consider

Opioid- compounds	Serotonergic-compounds	Adrenergic compounds	Probiotics
LOPERAMIDE diphenoxylate	alosetron cilansetron	clonidine	bifidobacterium infantis

somatostatin analog	muscarinic antagonists	other
octreotide	ATROPINE DICYCLOMINE hyoscyamine scopolamine	BISMUTH SUBSALICYLATE bismuth citrate

Learning Objectives

Physiology and Pathophysiology:

Describe the neural and hormonal mechanisms controlling colonic motility and water and electrolyte absorption and secretion.
Describe the conditions under which neural mechanisms controlling colonic motility and water and electrolyte absorption and secretion are impaired.
Describe the neural mechanisms of visceral sensation and visceral pain.
Describe the importance of maintaining normal gut flora and how disruption can lead to altered motility and absorption and secretion in the colon.

Mechanisms of action:

Explain the molecular mechanism of action of each drug in each drug class.

Actions on organ systems:

Describe the effects of each drug on the colon and also on other organ systems.

Pharmacokinetics:

Describe the absorption distribution metabolism and secretion of each drug.

Adverse effects, drug interactions and contraindications:

Describe the principal adverse effects of the drugs of each class.
Describe the clinically important drug interactions of the drugs of each class
Describe the principal contraindications of the drugs of each class

Therapeutic uses

Identify the specific therapeutic applications of each class of drug.

Clinical Pharmacology

Adequate replacement of fluid and electrolytes remains the primary approach to management so that clearance of the offending intestinal stimulant is removed.

Loperamide represents the primary opioid receptor agonist drug intervention that has minimal effects on the central nervous system. It is often useful in patients with chronic diarrhea secondary to treatment with chemotherapeutic drugs.

Use of bismuth subsalicylate is discouraged because of its potential to cause salicylate intoxication if it is used chronically. Other drug interventions are considered second line and rarely used because of associated adverse reactions.

Relevance

USMLE topic **Gastrointestinal System, Normal Processes –** organ structure and function including motility, digestion and absorption; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal defense mechanisms and normal flora **Abnormal Processes –** infection, inflammatory and immunologic disorders**;** systemic disorders affecting the gastrointestinal system; drug-induced adverse effects on the gastrointestinal system; idiopathic disorders	**Principles of therapeutics** Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; drugs to alter gastrointestinal motility
AAMC Medical School Objectives Project Report X Patient Safety-Table 1	**Topic C** Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease

Notes:

Drugs used for the Treatment of Inflammatory Bowel Disease			
Recommended Curriculum Equivalent: 0.5 hr			
Drug Classes and Drugs to consider			
Salicylates	Steroids	Anti-mitotic agents	Monoclonal antibodies
5-AMINO SALICYLIC ACID SULFAPYRIDINE SULFASALAZINE balsalazide	HYDROCORTISONE METHYLPREDNISOLONE PREDNISONE budesonide	6-mercaptopurine azathioprine cyclosporine methotrexate	INFLIXIMAB
Antibiotics		Probiotics	
ciprofloxacin clarithromycin metronidazole		VSL #2 lactobacillus	
Learning Objectives			
Pathophysiology: Describe the differences between ulcerative colitis and Crohn's disease. Describe the mechanisms responsible of intestinal and extraintestinal symptoms of inflammatory bowel disease. Describe the contribution of intestinal bacteria to the pathophysiology of inflammatory bowel disease.			
Mechanism of action Describe the mechanism of action of each of the major classes of drugs.			
Pharmacokinetics List the routes of administration of drugs in each class. Described the absorption and distribution of each class of drug and how this impacts on the choice of the route of administration. Describe the mechanisms for bioactivation of the salicylates and how this impacts on their use for the treatment of inflammatory bowel disease.			
Adverse effects, drug interactions and contraindications Describe the main adverse effects of the drugs of each class. Describe the clinically important drug interactions of the drugs of each class. Describe the principal contraindications or precautions of the drugs of each class.			
Therapeutic uses Know the selective use of each class of drug for the treatment of ulcerative colitis vs. Crohn's disease.			

Clinical Pharmacology

Subsequent to the finding of efficacy of sulfasalazine, it was determined that efficacy was mediated mostly by the 5-aminosalicylic acid that was released by sulfasalzine hydrolysis in the lower GI tract. Thus patients intolerant to sulfonamide drugs can be given 5-aminosalicylate directly to eliminate exposure to the sulfonamide moiety.

From a steroid perspective, prednisone is most cost effective with change to methylprednisolone in patients with hepatic impairment.

Use of infliximab remains a second line intervention for those patients having failed more established drug therapies.

Side effects from TNF-alpha inhibitions are significant, especially related to the increased susceptibility to infection.

Relevance

USMLE topic	**Principles of therapeutics**
Gastrointestinal System, Normal Processes – organ structure and function including motility, digestion and absorption; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal defense mechanisms and normal flora **Abnormal Processes –** inflammatory and immunologic disorders**;** systemic disorders affecting the gastrointestinal system; idiopathic disorders	Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; anti-inflammatory, immunosuppressive drugs
AAMC Medical School Objectives Project Report X Patient Safety-Table 1	**Topic C** Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease

Notes

Objectives for salicylates and steroids are covered under Analgesic, Antipyretic, Antiinflammatory Drugs

Objectives for mitotic inhibitors are covered under Chemotherapy Drugs

Drugs used to Treat Nausea and Vomiting	
Recommended Curriculum Equivalent: 1 hr	
Drug Classes and Drugs to Consider	
Emetic drugs	
Dopamine receptor agonist	Non-selective emetics
Apomorphine	Syrup of Ipecac

Anti-Emetic Drugs			
Dopamine receptor antagonists	5-HT_3 receptor antagonists	Cannabinoid receptor antagonists	Histamine receptor antagonists
METOCLOPRAMIDE PROCHLORPERAZINE haloperidol	DOLASETRON GRANISETRON ONDANSETRON PALONOSETRON ramosetron	DRONABINOL nabilone	DIMENHYDRINATE DIPHENHYDRAMINE cyclizine hydroxyzine meclizine promethazine
Neurokinin receptor antagonists	Corticosteroids	Benzodiazepines	Muscarinic receptor antagonists
APREPITANT	METHYL - PREDNISOLONE PREDNISONE dexamethasone	LORAZEPAM ALPRAZOLAM DIAZEPAM	SCOPOLAMINE

Learning Objectives

Physiology and Pathophysiology
Describe the central and peripheral nervous system mechanisms responsible for nausea and vomiting.

Mechanisms of action
Describe the mechanism of action of emetic drugs.
Explain the cellular and molecular mechanisms of action of each drug class.
Describe the use of multi-drug treatment of nausea and vomiting.

Actions on organ systems
Describe the pharmacological effects of each drug in each class.

Pharmacokinetics
Know the absorption, distribution, metabolism and excretion of each drug class.

Adverse effects, drug interactions and contraindications
Describe the principal adverse effects of the drugs of each class.
Describe the clinically important drug interactions of the drugs of each class
Describe the principal contraindications of the drugs of each class

Therapeutic uses
Know the appropriate uses of anti-emetic drugs for the treatment of specific conditions such as chemotherapy-induced nausea and vomiting, postoperative nausea and vomiting, motion sickness, vertigo, and nausea and vomiting during pregnancy.

Clinical Pharmacology

Syrup of ipecac is no longer recommended as an antiemetic, because of its lack of efficacy relative to the time of poison ingestion. It also has a potent sedative effect that could increase risk of aspiration pneumonia after induction of emesis.

Response to antiemetic drug treatment is highly variable among patients. These drugs are used most often in conjunction with chemotherapy, and are usually specified by protocol. Administration of dimenhydrinate or diphenhydramine should be done with caution because of their risk of abuse, and the narrow therapeutic index between efficacy and substantial toxicity.

The scopolamine patch is an effective antinauseant intervention and is successfully used for space travelers.

Relevance

USMLE topic	**Principles of therapeutics**
Gastrointestinal System, Normal Processes – organ structure and function including motility; **Central and Peripheral Nervous Systems –** brain stem; blood-brain barrier **Abnormal Processes –** idiopathic disorders; systemic disorders affecting the gastrointestinal system; drug-induced adverse effects on the gastrointestinal system	Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system; drugs to alter gastrointestinal motility; drugs affecting the autonomic nervous system
AAMC Medical School Objectives Project Report X Patient Safety-Table 1	**Topic C** Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease

Notes

Miscellaneous Gastrointestinal Drugs		
Antigas/Antiflatulent	Digestive Enzyme	Drug for Gallstones
SIMETHICONE activated charcoal	α-GALACTOSIDASE LACTASE PANCRELIPASE	ursodiol

Learning Objectives

Explain mechanism of action, effects, side effects, toxicities, pharmacokinetics and therapeutic uses of each agent.

Clinical Pharmacology

Activated charcoal should be used with caution because of the risk of impaction in the GI tract.

Relevance

USMLE topic Gastrointestinal System-Principles of therapeutics	**Principles of therapeutics** Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system Pancreatic replacement therapy and treatment of pancreatitis Other therapeutic modalities
AAMC Medical School Objectives Project Report X Patient Safety-Table 1	**Topic C** Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease
Notes	

Use of Drugs in Pharmacotherapy of Common Gastrointestinal Problems	
The course of instruction should include the pharmacotherapy of common gastrointestinal disorders including: "heart burn," gastroesopogeal reflux disorders, gastritis, bloating, distension, constipation (functional, acute, chronic, idiopathic, iatrogenic), diarrhea (functional, pathogenic, iatrogenic), peptic ulcer disease (duodenal, esophageal, gastric and inflammatory bowel diseases (Crohn's disease and ulcerative colitis), cramping and irritable bowel syndrome.	
Clinical Pharmacology Already addressed above in the specific section. When using opioid analgesics to manage pain associated with IBD, sufficient drug needs to be administered so as to counter that smooth muscle spasm induced by low doses of this class of drug. Dose should be mg/kg tailored to each patient.	
Relevance	
USMLE topic **Gastrointestinal System, Normal Processes –** organ structure and function including digestion; cell/tissue structure & function including endocrine and neural regulatory functions; gastrointestinal secretory products **Abnormal Processes –** idiopathic disorders	**Principles of therapeutics** Mechanisms of action and use of drugs for treatment of disorders of the gastrointestinal system
AAMC Medical School Objectives Project Report X Patient Safety-Table 1	**Topic C** Drug treatment of common conditions and diseases, using frequently prescribed classes of drugs for the treatment and prevention of disease
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