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Management of Diarrhea-predominant Irritable Bowel Syndrome with Focus on Viberzi and Xifaxan

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Goal. The goal of this lesson is to provide information on the irritable bowel syndrome with emphasis on the diarrhea-predominant form and two recently approved therapies, eluxadoline (Viberzi™) and rifaximin (Xifaxan®).

Objectives. At the completion of this activity, the participant will be able to:

1. recognize signs and symptoms, and key features of irritable bowel syndrome (IBS) including information on its prevalence;
2. list the Rome III criteria for IBS;
3. recognize the pharmacologic action(s), clinical application(s), dosage, and route of administration for the drugs used to treat diarrhea-predominant IBS;
4. demonstrate an understanding of adverse effects and toxicity, warnings, precautions, contraindications, and significant drug-drug interactions for drugs used to treat IBS with diarrhea; and
5. list important information relevant to IBS and its therapy to convey to patients and/or their caregivers.

Irritable bowel syndrome (IBS) is a functional bowel disorder characterized by chronic abdominal symptoms in the absence of major mechanical, inflammatory, biochemical or structural abnormalities as determined by routine clinical examination. IBS is one of the most common gastrointestinal (GI) conditions encountered in primary or secondary care. The condition is nearly twice as common in women as men, and most prevalent in persons under the age of 45, with peak prevalence from 20 to 39 years of age. In the past, IBS was referred to as colitis, mucous colitis, spastic colon, nervous colon, and spastic bowel. The term *irritable bowel syndrome* is used to convey that the disorder has both physical and psychological etiologies. Contrary to the opinion of some medical professionals, it is not simply a person's imagination. The exact cause is unknown.

Irritable Bowel Syndrome

IBS is classified into four subtypes according to predominant stool consistency pattern: IBS with constipation (IBS-C), IBS with diarrhea (IBS-D), mixed IBS whose stool type fluctuates between constipation and diarrhea (IBS-M), and unsubtyped (IBS-U). Some patients cannot be classified, and the predominant stool type often changes with time.

IBS is associated with significant reductions in health-related quality of life, as well as with impairments in psychosocial and workplace functioning. Symptoms can also impact patients' social well-being and ability to participate in leisure activities or undertake long journeys due to bowel movement frequency and unpredictability, for example. Moreover, IBS is associated with increased absenteeism and reduced work productivity. A 2002 survey of a large (n = 1,776) employed population showed that work productivity losses due to GI symptoms were 15 percent greater among employees with IBS compared with persons without the condition. Each employee with IBS had what amounted to an additional 39 days of reduced productivity at work and an additional 3.4 days of absences per year. The value of the loss in work productivity attributed to IBS-related gastrointestinal symptoms was estimated to exceed $7,700 per employee annually. In the United States, IBS imposes an estimated $20 billion in direct and indirect costs each year. This estimate does not include prescription or over-the-counter medications for IBS.

IBS accounts for an estimated 12 percent of all diagnoses made in the primary care setting. Primary care providers play an integral role in the management of IBS; overall, 83 percent of patients with IBS consult a primary care provider about their symptoms, versus 40 percent who consult a gastroenterologist. A prospective study of 112 patients diagnosed with IBS in the 1960s with long-term follow-up concluded that the presence of IBS did not increase the risk of mortality or of developing other GI diseases, such as chronic pancreatitis, GI cancers, small bowel obstruction, and peptic ulcers.

Etiology and Pathophysiology. The pathophysiology of IBS remains incompletely defined. One study identified a threefold increase in the risk of IBS in

persons who had an immediate family member with a history of the condition. In addition to a familial relationship, other postulated etiologies for IBS include disturbances in GI motility, mucosal barrier disruption, visceral hypersensitivity, dysfunction of the gut-brain axis (neurohormonal interactions between the CNS and the gut), and a stress response with involvement of one or more neurotransmitters. Reduced plasma serotonin levels may be correlated with constipation-predominant IBS, whereas increased serotonin release may play a role in diarrhea-predominant IBS.

There is an association between IBS and psychological disorders (e.g., anxiety, depression, post-traumatic stress disorder), with up to two-thirds of patients with IBS in tertiary care centers also having a concurrent psychological disorder. Prior physical and sexual abuse is predictive of severe IBS symptoms. In a study of 257 persons with severe IBS, 12 percent reported a history of rape, with patients showing improved quality of life following psychological treatment and antidepressant therapy. Recent research has suggested quantitative and qualitative differences in the gut microbiota (i.e., gut flora) between IBS patients and controls. In a systematic review of 18 prospective studies, infectious gastroenteritis was associated with increased risk for subsequently developing IBS.

Prevalence. Population-based studies have demonstrated that the prevalence of symptoms of IBS in the community varies from around 5 percent to more than 20 percent. A systematic review of 80 separate cross-sectional surveys involving 260,960 subjects confirmed that prevalence varied considerably among nations, with a pooled prevalence of 7 percent in Southeast Asia, 12 percent in northern North America and Europe, and 21 percent in South America. According to the predominant stool form, IBS-D was the most common subtype, with a pooled prevalence of 40 percent. IBS-M was the least common, with a pooled prevalence of 23 percent. There was a female preponderance, with a pooled odds ratio of 1.67 for IBS in women versus men. Women with IBS were more likely to have IBS-C and less likely to meet criteria for IBS-D than men with IBS.

Clinical Presentation. Abdominal pain is the most common symptom and often is described as a cramping sensation, which may be severe. Emotional stress and eating may worsen the pain, and defecation may relieve it. Pain that is progressive or awakens the patient from sleep, or pain associated with anorexia, malnutrition, or weight loss is not characteristic of IBS.

Diarrhea is described as frequent bowel movements preceded by lower abdominal cramping. Patients with diarrhea may sense a feeling of urgency and incomplete relief after defecation, and may have mucus in the stools. Large volume, bloody, and nocturnal diarrhea are not characteristic of IBS.

Additional GI symptoms of IBS include the feeling of a lump in the throat (globus sensation), belching, acid reflux, dysphagia (difficulty swallowing), early satiety, intermittent dyspepsia, nausea, noncardiac chest pain, abdominal bloating, and flatulence. Extraintestinal symptoms include dysmenorrhea, dyspareunia (difficult or painful coitus in women), urinary urgency or frequency, and fibromyalgia. The absence of abdominal pain, as well as other IBS symptoms such as pain relieved by defecation, passage of mucus via the rectum, and feeling of incomplete evacuation, have strong negative predictive value and essentially exclude IBS.

Clinical Assessment. IBS is a complex and controversial disorder: symptoms are non-specific, patients are heterogeneous, and evaluation and management vary dramatically from provider to provider. Some physicians, whether general practitioners or gastroenterologists, believe that IBS is a distinct functional disorder of the GI tract that is well defined using the biopsychosocial model. Another group views IBS as a conglomerate of different serious diseases, most of which, and perhaps all, are organic in nature. They theorize that in the future these organic causes will be identified and IBS as a diagnostic entity will disappear. Others simply do not believe that IBS exists at all, and they defend their view by stating that the symptoms are normal and patients should deal with them since they are not a medical priority. Thus, there are believers, skeptics, and non-believers who are involved in evaluation and treatment (perhaps non-treatment in some cases) of IBS patients who are desperately searching for symptom relief.

There is no specific test for diagnosing IBS; thus, obtaining a detailed patient history matched with clinical symptoms are key features for diagnosis. IBS is diagnosed by applying the Rome III criteria and ruling out red-flag (i.e., alarm) symptoms that may be caused by other organic GI diseases. Rome III is a system developed to classify functional GI disorders. These are disorders in which symptoms cannot be explained by the presence of structural or tissue abnormalities.

The Rome III criteria define IBS as recurrent abdominal pain or discomfort associated with alterations in defecation and changes in stool consistency. Recurrent abdominal pain or discomfort for three or more days per month during the preceding three months that are associated with two or more of the following is diagnostic of IBS: improvement of symptoms upon defecation, onset associated with change in form and/or appearance of stool, abnormal stool frequency, straining during defecation, urgency or feeling of defecation, mucus in the stool and bloating. Red-flag symptoms that indicate a more serious abdominal disorder or GI disease other than IBS include anemia, weight loss, rectal bleeding, nocturnal or progressive abdominal pain, severe diarrhea or vomiting, delayed

puberty, fever of unknown origin, and family history of inflammatory bowel disease, colorectal cancer, or celiac sprue. It is suggested that diagnosis should be reached using symptom-based clinical criteria, rather than via excluding underlying organic disease by exhaustive investigation, which can lead to considerable financial burden to the healthcare system.

Treatment

Despite the outcomes of numerous studies targeting treatment for IBS-D, the condition can be debilitating and there is currently no universally accepted satisfactory treatment protocol for this condition. Advice provided in Table 1 may help patients cope with their disease.

The primary goals of therapy are to eliminate severe symptoms, reduce the number of exacerbations, identify and treat any comorbidities including psychosocial factors, and improve quality of life. Several studies use global assessment, a global measure that includes overall well-being, abdominal pain/discomfort and bowel function, as a primary endpoint to evaluate the success of treatment. In the past, treatments for IBS-D have been largely limited to pharmacotherapy aimed at relieving individual symptoms.

Antispasmodics. A review of 29 randomized controlled trials involving 2,333 patients showed that antispasmodics were effective in improving abdominal pain, global assessment, and symptom score compared to placebo or no treatment, although there was significant heterogeneity among studies. Common adverse events with antispasmodics include dry mouth, dizziness, and blurred vision. Antispasmodics in use in the United States include hyoscyamine (Levsin) and dicyclomine (Bentyl). Hyoscyamine is the levo-isomer of atropine, a belladonna alkaloid that competitively and reversibly inhibits the acetylcholine receptor on smooth muscle, including contractions and GI motility. Dicyclomine is a weak muscarinic receptor antagonist with nonspecific direct spasmolytic effects on the GI tract. Peppermint oil also has antispasmodic properties to bring about smooth muscle relaxation via calcium channel blockade. Literature support for use of antispasmodics in IBS-D is weak.

Fiber. A review of 12 randomized controlled trials involving 621 patients showed no beneficial effect for either soluble or insoluble fiber over placebo for improvement in abdominal pain, global assessment, or symptom score. Therefore, there is no solid evidence to substantiate fiber's benefit for treating IBS-D. Fiber supplements may be poorly tolerated, with adverse effects including bloating, abdominal distention, and flatulence.

Synthetic Opioids. Loperamide (Imodium) decreases intestinal transit and enhances intestinal water and ion absorption. It is the sole antidiarrheal that has been sufficiently evaluated for IBS. A systematic review of three randomized controlled trials involving 126 patients with IBS-D showed that loperamide was effective at decreasing stool frequency and increasing stool consistency; however, it did not improve abdominal pain and increased nocturnal pain. Diphenoxylate/atropine (Lomotil) has not been sufficiently studied in patients with IBS.

Complementary and Alternative Medicine (CAM). CAM therapies including probiotics, herbal therapies, acupuncture, and yoga are commonly tried and often initiated by patients independently or on the advice of a healthcare provider. In a survey of patients with functional bowel disorders, 35 percent reported using some form of CAM. Evidence supporting the use of probiotics for IBS is weak due to the heterogeneity of studies and the varying probiotics studied. However, a systematic review of 10 randomized controlled trials involving 918 patients with IBS revealed a significant benefit for reducing symptoms and decreasing pain and flatulence. Another systematic review of 14 randomized controlled trials showed a modest improvement in overall symptoms, abdominal pain, and flatulence in patients taking probiotics versus placebo. There does not appear to be a significant difference in outcome among *Lactobacillus*, *Streptococcus, Bifidobacterium* and combinations of probiotics. The magnitude of effect and the most effective species, strain and dosage are unknown.

Table 1
Patient advice for IBS-D*

- IBS-D is not an ulcer or cancer, does not lead to either condition, and is not life-threatening. Symptoms occur because the intestinal tract is not functioning properly. With corrective treatment, you can lead a normal, active, and healthy life;
- Follow your doctor's advice carefully on pursuing tension-relieving activities including sports, hobbies, and physical exercise. A positive self-image and extroverted personality will help control symptoms;
- Avoid chewing gum, drinking carbonated beverages, and ingesting other food and confectionery items that increase the swallowing of air;
- Breath mints and other confections that contain sorbitol or mannitol may cause excessive flatus or diarrhea and worsen symptoms. Avoid their use if they aggravate your condition;
- Avoid caffeine or alcohol-containing beverages, and tobacco products;
- A moist heat source placed on your abdomen may help relieve severe spasm and cramping;
- Eat at approximately the same times each day, chew your food slowly and thoroughly, and drink eight to 10 glassfuls of fluid each day;
- Avoid foods that are known to cause discomfort. Your doctor or pharmacist can help you plan a healthy diet;
- Tell your doctor and pharmacist about all the drugs you take, including prescription and nonprescription drug items, and any natural products and dietary supplements;
- Although your condition may be controlled satisfactorily with nonprescription products, it is important that you visit your doctor regularly.

*IBS-D = Diarrhea-predominant irritable bowel syndrome

Antidepressants. A review of 15 studies involving 922 patients showed benefit with antidepressants over placebo for improvement in abdominal pain, global assessment, and symptom score. Statistically significant benefit was shown with selective serotonin reuptake inhibitors for improvement of global assessment, and with tricyclic antidepressants for improvement of abdominal pain and symptom score.

Alosetron (Lotronex). Because alosetron is associated with uncommon but serious adverse events, including ischemic colitis, severe constipation, and death, there are restrictions for its use in the United States. This selective serotonin 5-HT_3 antagonist is indicated only for women with severe IBS-D who have chronic symptoms generally lasting six months or longer, had anatomic or biochemical abnormalities of the GI tract excluded, and not responded adequately to conventional therapy.

Exercise and Diet. A randomized controlled trial enrolling 102 patients with IBS showed that subjects randomized to physical activity exhibited fewer IBS symptoms compared with the control group (8 vs 23 percent). There is no evidence to support testing for food allergies or following exclusion diets in the treatment of IBS; however, a food diary may be useful in individual patients to assess an association between certain foods and IBS symptoms.

Placebo Response. The placebo response rate is high with IBS. A meta-analysis of 73 randomized placebo-controlled trials in IBS showed a pooled placebo response rate of almost 40 percent. A recent trial recruited and randomized 80 patients in tertiary care to either open label placebo, which they were told had beneficial effects through mind-body self-healing processes, or no treatment. Almost half of the patients in the placebo group reported adequate relief of symptoms, which was significantly higher than with no treatment. The authors suggested that such novel strategy supports the ethical use of a placebo as treatment, without the need for deception of the patient, which would otherwise undermine the patient-doctor relationship.

Two New Drugs. Recently, FDA approved two new treatments (Table 2) for IBS-D in adult men and women: eluxadoline (Viberzi) and rifaximin (Xifaxan). Viberzi contains a new active ingredient. Xifaxan was previously approved for travelers' diarrhea caused by *Escherichia coli* and for reduction of the risk of recurring overt hepatic encephalopathy, changes in brain function that occur when the liver is unable to remove toxins from the blood.

Eluxadoline (Viberzi)

Mechanism of Action. Opioid receptors, including mu, delta, and kappa, are expressed along the GI tract and exert a key function in regulating GI motility, secretion, and visceral sensation. Exogenous opioids reduce GI transit through activation of mu-opioid receptors and can treat diarrhea in acute situations. Drugs that simultaneously activate mu-opioid receptors and antagonize delta-opioid receptors have differential GI effects and possess increased analgesic potency compared with pure mu-receptor agonists. Such a mixed mu-agonist/delta-antagonist profile may, therefore, offer an advantage in treating both the diarrhea and abdominal pain associated with IBS-D. Eluxadoline (Viberzi [vye-BER-zee]) has mixed opioid receptor activity: it is a mu-opioid receptor and kappa-opioid receptor agonist, and a delta-opioid receptor antagonist with low oral bioavailability. Simultaneous stimulation of the mu-opioid receptor and antagonism

Table 2
New drugs for treatment of IBS with diarrhea

Generic (Trade Name)	Distributor	Indication	Dose*	Dosage Form	Most Common Side Effects	Medication Guide‡
Eluxadoline (Viberzi)	Forest Pharmaceuticals	IBS with diarrhea	100 mg PO twice daily	75, 100 mg tablets	(≥5%): constipation, nausea, abdominal pain	Yes
Rifaximin (Xifaxan)	Salix Pharmaceuticals	IBS with diarrhea; travelers' diarrhea; reduce risk of of overt hepatic encephalopathy recurrence	550 mg PO three times daily for 14 days	200, 550 mg tablets	(IBS-D ≥2%): increased ALT, nausea; (TD ≥2%): headache; (HE ≥10%): peripheral edema, nausea, dizziness, fatigue and ascites§	No

*Recommended dose for most patients with IBS-D

‡Availability at the time of publication of this lesson

§TD: Travelers' diarrhea; HE: hepatic encephalopathy

of the delta-opioid receptor can, therefore, reduce abdominal pain and diarrhea in patients with IBS-D without causing constipating adverse effects.

Efficacy and Safety. Efficacy of eluxadoline was established in 2,426 subjects enrolled in two Phase III clinical trials. Demonstrating significant superiority over placebo on the composite endpoint of simultaneous improvement in both abdominal pain and diarrhea at both 75 mg and 100 mg doses taken twice daily, the primary efficacy responder endpoint was evaluated over the duration of double-blind, placebo-controlled treatment. Response rates were compared based on patients who met the daily composite response criteria (improvement in both abdominal pain and stool consistency on the same day) for at least 50 percent of the days from weeks one to 12 (FDA endpoint) and weeks one to 26 (European Medicines Agency endpoint).

The most common adverse events in the two clinical trials included constipation (7 percent and 8 percent) for eluxadoline 75 mg and 100 mg (2 percent for placebo) and nausea (8 percent and 7 percent) for eluxadoline 75 mg and 100 mg (5 percent for placebo). Rates of severe constipation were less than 1 percent in patients receiving both doses of eluxadoline. Approximately half of constipation events occurred within the first two weeks of therapy and the majority occurred within the first three months of therapy.

In the two studies conducted in recreational opioid-experienced individuals, euphoria was reported at a rate of 14 percent to 28 percent; thus, the data suggested that eluxadoline may produce psychological dependence. FDA recommended to the U.S. Drug Enforcement Administration (DEA) that Viberzi be classified as a controlled substance. DEA then classified Viberzi a Schedule IV controlled substance.

Warnings, Precautions, and Contraindications. The following **warnings** and **precautions** are listed:

• *Sphincter of Oddi spasm*: Monitor patients without a gallbladder for new or worsening abdominal pain, with or without nausea and vomiting, or acute biliary pain with liver or pancreatic enzyme elevations. Discontinue Viberzi and seek medical attention if symptoms develop.

• *Pancreatitis*: There is potential for increased risk of pancreatitis not associated with sphincter of Oddi spasm. The majority of cases are associated with excessive alcohol intake. Patients should stop Viberzi and seek medical attention if they experience symptoms suggestive of pancreatitis such as acute abdominal or epigastric pain radiating to the back associated with elevations of pancreatic enzymes.

Contraindications include use in patients with:

• *Known or suspected biliary duct obstruction, or sphincter of Oddi disease or dysfunction.* These patients are at increased risk for sphincter of Oddi spasm.

• *Alcoholism, alcohol abuse, alcohol addiction, or persons who drink more than three alcoholic beverages/day*. These patients are at increased risk for acute pancreatitis.

• *A history of chronic or severe pancreatitis or structural diseases of the pancreas, including known or suspected pancreatic duct obstruction*. These patients are at increased risk for acute pancreatitis.

• *Severe hepatic impairment (Child-Pugh Class C)*. These patients are at increased risk for significantly increased plasma concentrations of eluxadoline.

• *A history of severe constipation or sequelae from constipation, or known or suspected mechanical gastrointestinal obstruction*. These patients may be at risk for severe complications of bowel obstruction.

Drug Interactions. The metabolism of eluxadoline by CYP pathways has not been clearly established. In addition, the potential of eluxadoline to inhibit CYP3A4 in the gut has not been established.

Table 3
Patient information for Viberzi *

Inform patients:
- to read the FDA-approved *Medication Guide* with each new or refill prescription for this drug;
- to stop Viberzi and seek medical attention if unusual or severe abdominal pain develops, especially if they do not have a gallbladder;
- to avoid chronic or acute excessive alcohol use while taking Viberzi;
- to take one tablet twice daily with food;
- that if they miss a dose, take the next dose at the regular time. Do not take two doses at the same time to make up for a missed dose;
- to call their healthcare provider if they are unable to tolerate Viberzi;
- to discontinue Viberzi and call their healthcare provider if they experience constipation with the drug lasting more than four days;
- to not take alosetron (Lotronex) with Viberzi, or take loperamide (Imodium) on a chronic basis with Viberzi due to the potential for constipation. Loperamide may occasionally be used with Viberzi for short-term management of severe diarrhea, but must be discontinued if constipation develops. Also, avoid taking Viberzi with other drugs that may cause constipation (for example, opioids, anticholinergics, etc.).

*A complete list of information is available in the product's *Medication Guide*.

An extensive list of drugs that have demonstrated a clinically important drug interaction with eluxadoline or that potentially may result in clinically relevant interactions is given in the Prescribing Information leaflet.

Administration, Dosing, and Availability. The recommended dosage of Viberzi in adults is 100 mg twice daily taken with food. The recommended dosage is 75 mg twice daily taken with food in patients who do not have a gallbladder, are unable to tolerate the 100 mg dose, are receiving concomitant OATP1B1 inhibitors (e.g. cyclosporine, antiretrovirals, gemfibrozil), or have mild or moderate hepatic impairment. Viberzi use in

Table 4
Patient information for Xifaxan*

Inform patients:
• that Xifaxan may be taken with or without food;
• to take the medication exactly as directed. Skipping doses or not completing the full course of therapy may decrease the effectiveness of the immediate treatment, and increase the likelihood that bacteria will develop resistance and will not be treatable by Xifaxan in the future;
• that taking Xifaxan for uses other than what the doctor prescribed may increase the chance of developing resistance to the drug so that it will not be as effective for treating IBS-D in the future.

*A complete list of information is available in the product's Prescribing Information leaflet.

patients who develop severe constipation for more than four days should be discontinued. If a dose is missed, the patient should take the next dose at the regular time, and not take two doses at once. Viberzi is available as capsule-shaped tablets containing 75 mg and 100 mg.

Patient Counseling. An FDA-approved *Medication Guide* must be dispensed with each new or refilled prescription for Viberzi. Specific points for counseling are summarized in Table 3.

Rifaximin (Xifaxan)

Mechanism of Action. Rifaximin is a semi-synthetic structural analog of rifampin that is poorly absorbed (<0.4 percent), resulting in the bulk of the dose being contained in the intestinal lumen. Xifaxan (zi-FAX-en) is the first and only nonsystemic antibiotic approved for treatment of IBS in adults. It was previously approved for treatment of travelers' diarrhea caused by noninvasive strains of *Escherichia coli* in adults and pediatric patients 12 years of age and older, and to reduce the risk of overt hepatic encephalopathy occurrence in adults.

The drug has a broad range of activity, covering anaerobes and Gram-positive and Gram-negative organisms. Rifaximin is especially active in reducing bacterial overgrowth within the small intestine. The precise mechanism by which rifaximin improves IBS symptoms remains incompletely defined, but proposed actions include elimination of the intestinal microbiota that produce toxins which induce IBS symptoms, reduction of local mucosal interaction with the bacteria that results in less irritation, or both. These actions align with the small intestine bacterial overgrowth theory.

Efficacy and Safety. Safety and effectiveness of Xifaxan for treatment of IBS-D were established in three double-blind, placebo-controlled trials. In the first two trials, 1,258 patients were randomly assigned to receive Xifaxan or placebo for 14 days, followed by a 10-week treatment-free period. More Xifaxan-treated patients reported improvements in abdominal pain and stool consistency than those on placebo. A third trial evaluated repeat courses of Xifaxan, because patients with IBS-D can develop recurrent signs and symptoms after a single treatment course of Xifaxan. A total of 636 patients with recurrence were randomized to receive either Xifaxan or placebo for two additional 14-day courses separated by 10 weeks. More patients treated with Xifaxan than placebo were responders in abdominal pain and stool consistency in this phase of the study.

The most common adverse events in patients treated with Xifaxan for IBS-D include nausea and an increase in alanine aminotransferase (ALT). If diarrhea does not improve or worsens after treatment with Xifaxan, then evaluation for development of a severe infectious diarrhea, *Clostridium difficile* enterocolitis, should be performed. Caution should be used when using Xifaxan in patients with severe liver impairment or when combined with certain other drugs.

Warnings, Precautions, and Contraindications. The following **warnings** and **precautions** are listed:

• *Travelers' diarrhea not caused by E. coli*: Xifaxan was not effective in diarrhea complicated by fever and/or blood in the stool or diarrhea due to pathogens other than *E. coli*. If diarrhea symptoms worsen or persist for more than 24 to 48 hours, discontinue Xifaxan and consider alternative antibiotics.

• *Clostridium difficile-associated diarrhea*: Evaluate if diarrhea occurs after therapy or does not improve or worsens during therapy.

• *Development of drug-resistant bacteria*.

• *Hepatic impairment*: Use with caution in patients with severe (Child-Pugh Class C) hepatic impairment.

• *Concomitant use with P-glycoprotein (P-gp) inhibitors*: Exercise caution when concomitant use of Xifaxan and a P-gp inhibitor is needed (See Drug Interactions, below).

Contraindications include a history of hypersensitivity to rifaximin, rifamycin antimicrobial agents, or any of the components of Xifaxan. Hypersensitivity reactions have included exfoliative dermatitis, angioneurotic edema, and anaphylaxis.

Drug Interactions. *In vitro* studies suggested that rifaximin is a substrate of P-gp, OATP1A2, OATP1B1 and OATP1B3. Concomitant use with cyclosporine, an inhibitor of P-gp and OATPs, significantly increased the systemic exposure to rifaximin. The clinical significance of this increase in systemic exposure is unknown.

Administration, Dosing, and Availability. To treat IBS-D, Xifaxan is administered orally at a dose of 550 mg three times daily with or without food for 14 days. Patients who experience recurrence can be retreated up to two times with the same regimen. Considering the declining effect of rifaximin over time, as observed in clinical trials, and the potential for

antibiotic resistance with repeated use, there is concern regarding the continued effectiveness of rifaximin retreatment in patients with IBS. Xifaxan is available as tablets containing 550 mg for treatment of IBS-D or hepatic encephalopathy, and 200 mg to treat travelers' diarrhea.

Patient Counseling. Specific points for patient counseling are summarized in Table 4.

Overview and Summary

Management of IBS can be a challenge to healthcare professionals because there is no specific treatment protocol approved to mitigate its symptoms or prevent its onset. The most common form, IBS-D, can be especially debilitating and contribute to impaired health-related quality of life. The two recently approved therapies, Viberzi and Xifaxan, offer novel approaches to its management and thus, offer renewed hope for patients.

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1. All of the following are true about IBS EXCEPT:
   a. it is more common in women than men.
   b. its peak prevalence is from age 39 to 60 years.
   c. it is classified into four subtypes.
   d. it accounts for an estimated 12 percent of all diagnoses made in primary care.

2. All of the following are true about IBS EXCEPT:
   a. IBS-D is the most common subtype.
   b. the pathophysiology is incompletely defined.
   c. sexual abuse is predictive of severe IBS symptoms.
   d. large volume and bloody diarrhea are characteristics of IBS.

3. The Rome III criteria for defining IBS includes recurrent abdominal pain or discomfort:
   a. 2 or more days/month during the preceding month.
   b. 2 or more days/month during the preceding 2 months.
   c. 3 or more days/month during the preceding 2 months.
   d. 3 or more days/month during the preceding 3 months.

4. All of the following are appropriate counseling points for patients with IBS-D EXCEPT:
   a. IBS-D is not life-threatening.
   b. avoid chewing gum and drinking carbonated beverages.
   c. breath mints containing sorbitol may worsen symptoms.
   d. avoid moist heat sources applied to the abdomen.

5. Antispasmodics available in the U.S. include all of the following EXCEPT:
   a. dicyclomine.
   b. hyoscyamine.
   c. alosetron.
   d. peppermint oil.

6. In a survey of patients with functional bowel disorders, what percentage of patients used complementary and alternative medicine (CAM) therapy?
   a. 10 percent
   b. 25 percent
   c. 35 percent
   d. 60 percent

7. Alosetron is classified as an antagonist of:
   a. acetylcholine.
   b. delta-opioid receptors.
   c. norepinephrine.
   d. serotonin.

8. Eluxadoline is classified as a mixed:
   a. mu-receptor agonist, kappa-receptor antagonist.
   b. mu-receptor agonist, delta-receptor antagonist.
   c. kappa-receptor agonist, mu-receptor antagonist.
   d. delta-receptor agonist, kappa-receptor antagonist.

9. One of the most common adverse events in clinical trials with eluxadoline was:
   a. ascites.
   b. constipation.
   c. dizziness.
   d. headache.

10. Which of the following is a warning/precaution for Viberzi?
   a. Exfoliative dermatitis
   b. Gastrointestinal obstruction
   c. Development of drug-resistant bacteria
   d. Sphincter of Oddi spasm

11. Which of the following is the recommended dose for Viberzi?
   a. 75 mg daily
   b. 100 mg twice daily
   c. 75 mg three times daily
   d. 100 mg three times daily

12. The most common adverse event in patients treated for IBS-D with rifaximin was:
   a. abdominal pain.
   b. angioneurotic edema.
   c. constipation.
   d. nausea.

13. Patients who experience recurrence of IBS-D symptoms with Xifaxan can be retreated up to how many times with the same dose regimen?
   a. One
   b. Two
   c. Three
   d. Four

14. Which of the following was previously approved for treatment of travelers' diarrhea caused by *E. coli*?
   a. Xifaxan
   b. Viberzi

15. Which of the following is appropriate advice for counseling patients taking Xifaxan?
   a. Read the FDA-approved *Medication Guide* with each new or refilled prescription.
   b. Xifaxan may be taken with or without food.
   c. Stop taking the medication as soon as diarrhea stops.
   d. Do not take the medication concurrently with loperamide.

Completely fill in the lettered box corresponding to your answer.

1. [a] [b] [c] [d]	6. [a] [b] [c] [d]	11. [a] [b] [c] [d]
2. [a] [b] [c] [d]	7. [[a] [b] [c] [d]	12. [a] [b] [c] [d]
3. [a] [b] [c] [d]	8. [a] [b] [c] [d]	13. [a] [b] [c] [d]
4. [a] [b] [c] [d]	9. [a] [b] [c] [d]	14. [a] [b]
5. [a] [b] [c] [d]	10. [a] [b] [c] [d]	15. [a] [b] [c] [d]

❑ **I am enclosing $5 for this quiz made payable to Ohio Pharmacists Association.**

1. Rate this lesson: (Excellent) 5 4 3 2 1 (Poor)
2. Did it meet each of its objectives? ❑ yes ❑ no
   If no, list any unmet_____
3. Was the content balanced and without commercial bias?
   ❑ yes ❑ no If no, why?_____
4. Did the program meet your educational/practice needs?
   ❑ yes ❑ no
5. How long did it take you to read this lesson and complete the quiz? _____
6. Comments/future topics welcome.

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