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October 2007 "Management of *H. pylori* Infection" 707-000-07-010-H01-P



THIS MONTH--
"H. pylori
Management"

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H. pylori is a gram negative organism found within the gastric mucosa. It is a major cause of PUD. Controlling it can successfully combat large numbers of the condition. This lesson provides 1.25 hours (0.125 CEUs) of credit, and is intended for pharmacists in all practice settings.

The program ID # for this lesson is 707-000-07-010-H01-P.

Pharmacists completing this lesson by October 31, 2010 may receive full credit.

To obtain continuing education credit for this lesson, you must answer the questions on the quiz (70% correct required), and return the quiz. Should you score less than 70%, you will be asked to repeat the quiz. Computerized records are maintained for each participant.

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The objectives of this lesson are such that upon completion the participant will be able to:

1. Discuss management of *H. pylori* infection.
2. Differentiate between invasive & noninvasive tests for *H. pylori* detection.
3. List treatment options for *H. pylori* infection.
4. Discuss antibiotic resistance as related to treating *H. pylori*.

All opinions expressed by the author/authors are strictly their own and are not necessarily approved or endorsed by W-F Professional Associates, Inc. Consult full prescribing information on any drugs or devices discussed.

INTRODUCTION

Helicobacter pylori (formerly known as *Campylobacter pylori*) is a gram negative rod organism found within the gastric mucosa and on occasion in the duodenal or esophageal mucosal epithelium. This organism can cause chronic and life-long infection and is recognized as a worldwide problem. Prevalence varies from country to country with the larger proportion of cases in the developing world. Occurrence is inversely related to socioeconomic status. Most individuals acquire the infection during childhood.^{1,2} Modes of transmission include gastro-oral and fecal-oral routes, as well as through contaminated food or water.² Iatrogenic spread through contaminated endoscopes has also been documented.

In the United States infection rates are low among the economically privileged. Infection is more commonly found among minority populations, older adults and low socioeconomic groups. A decrease in the frequency of infection has been observed among industrialized countries. Improvement in living conditions is considered responsible for the decreased prevalence. Even when *H. pylori* is considered a chronic infection, there have been reports of spontaneous elimination of the infection.²

Infection with *H. pylori* is primarily silent with little clinical symptoms. The bacteria colonize the gastric mucosa causing inflammation. The mechanisms for tissue injury are not well defined. All infected individuals will develop chronic diffuse superficial gastritis. Over years and decades, chronic *H. pylori* gastritis can lead to many gastrointestinal (GI) complications.

H. pylori can cause conditions that include chronic gastritis and peptic ulcer disease. The two major causes of peptic ulcer disease include *H. pylori* and use of non-steroidal anti-inflammatory drugs (NSAIDs). According to the Center for Disease Control (CDC), approximately 25 million Americans suffer from peptic ulcer disease at some point in their lifetime. Each year there are 500,000 to 850,000 new cases of peptic ulcer disease and more than one million ulcer-related hospitalizations.³

The World Health Organization has classified this organism as a class 1 carcinogen.⁴ It has been linked as a cause for non-Hodgkin's mucosa-associated (MALT) lymphoma and indirectly to gastric adenocarcinoma.²

Dyspepsia is a term commonly used to describe many gastrointestinal symptoms, ranging from upper abdominal pain to heartburn, nausea, bloating and retrosternal pain. Many patients do not have any abnormal findings on endoscopy, and their symptoms are commonly referred to as functional dyspepsia. The role of *H. pylori* in dyspepsia is less clear. A small group of patients with functional dyspepsia will benefit from *H. pylori* eradication.^{1,5} Testing for *H. pylori* in patients with uninvestigated dyspepsia is recommended for areas of high prevalence.

With regards to Gastroesophageal Reflux Disease (GERD), the associations between *H. pylori* infection and GERD symptoms are very complex. Available data has reported improvement, no change or worsening of GERD symptoms in relation to *H. pylori* infection.¹ The role of this infection with regards to improvement or worsening of symptoms is controversial and may be related to the complex nature of this disease. Regardless of ongoing controversy, treatment for *H. Pylori* should be offered in patients with active GERD symptoms for which treatment is indicated.

A possible association between *H. pylori* infection and unexplained iron deficiency anemia has been suggested.¹ The exact mechanism for this association is not well defined. Emerging evidence proposes that eradication of *H. pylori* can improve iron deficiency anemia. Results have been conflicting, and, therefore, it remains controversial.

Given the number of GI conditions linked to *H. pylori* diagnosis, treatment can lead to significant clinical improvement of many of these conditions. Eradication of this organism can provide significant cost benefit,

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especially if compared to long-term acid suppressive therapy.⁶

The American College of Gastroenterology recommends the diagnosis and treatment of *H. pylori* in the following settings: active peptic ulcer disease (gastric or duodenal), confirmed history of peptic ulcer disease (not previously treated), gastric MALT lymphoma (low grade), after endoscopic resection of earlier gastric cancer, uninvestigated dyspepsia (depending on *H. pylori* prevalence). The diagnosis and treatment is considered controversial for the following settings: non-ulcer dyspepsia, GERD, persons using NSAIDs, unexplained iron deficiency anemia and populations at higher risk for gastric cancer.¹

The methods of testing for *H. pylori* can be separated between **invasive** and **non-invasive** techniques. No single test is sufficient to make a diagnosis, and in many cases a definitive diagnosis requires a combination of tests. The individual clinical setting, prevalence of infection and the cost associated with the test should be considered at the time of selecting the most appropriate method for diagnosis.

INVASIVE TESTS

Endoscopy

This is an expensive procedure with rare but serious complications like hemorrhage and perforation.⁷ In addition to higher costs, it can lengthen the time of diagnosis, since it requires specialized facilities. Endoscopy provides the opportunity for biopsy-based diagnostic methods. **These methods include rapid urease testing (RUT), histology, culture and DNA amplification via polymerase chain reaction (PCR).** The use of acid suppressive agents like H-2 blockers and PPIs within 1-2 weeks prior to the test, or the use of antibiotics with activity against *H. pylori* within 4 weeks of the test will potentially decrease the sensitivity of the test.

Helicobacters are characterized by their high production of urease. All clinical isolates of *H. pylori* are urease positive. **RUT** is inexpensive and can provide rapid results. It identifies active infection via urease activity from the organism. Results can be available in 1-24 hours, and many commercial kits are available with high sensitivity and specificity.^{1,7} The sensitivity of RUT can be decreased if the patient has taken medication that decreases urease activity of *H. pylori*. Such compounds include antibiotics, bismuth products and PPIs. The broad use of PPIs including OTC products has become a problem, and, therefore, many clinicians use RUT tests in combination with other methods. Acute ulcer bleeding may also decrease sensitivity and may require retesting once bleeding has resolved.

Histology not only will provide information on the organism, but also on inflammatory changes associated with the infection, such as atrophy and malignancy. Detection of *H. pylori* by this method will be affected by not only the site, size and number of biopsies, but by staining techniques used. It is recommended that multiple biopsies from various areas be obtained to accurately diagnose the infection.¹

Bacterial culture is another specific method to identify *H. pylori*. It not only identifies the organisms, but allows practitioners to perform antibiotic susceptibility testing. The disadvantage of this method is that cultures are not very sensitive, and they require special techniques that may not be practical for all clinical laboratories. **PCR** techniques allow identifying a specific DNA sequence to *H. pylori*. This method may be the most sensitive of all the above methods; however, it is currently a research tool not commonly available.

NON-INVASIVE TESTS

They can be divided between **passive and active tests**. Passive tests provide evidence of exposure to *H. pylori*. Passive tests do not distinguish between active or inactive infection. Active tests provide evidence of ongoing infection.

Passive tests include antibody tests. It relies on the detection of IgG antibodies specific to *H. pylori*. Antibody testing can be conducted in serum, urine or whole blood. Antibodies to *H. pylori* are developed approximately 21 days after infection and remain positive long after eradication.¹ Advantages are low cost and widespread availability. Sensitivity and specificity may vary depending on *H. pylori* prevalence. Antibody testing should be avoided in areas of low prevalence, or positive results should be confirmed with other tests.

Available active tests include urea breath tests (UBT) and fecal antigen tests. The UBT, like the RUT, relies on the organism's urease activity to identify *H. pylori*. Patients ingest radiolabeled urea that produces labeled CO₂ in the presence of the organism and is quantified in expired breath. The amount of radiation is less

than daily background exposure. It has good specificity and sensitivity, and is a good post-treatment test. Like with the RUT, prior PPI and antibiotic use will decrease sensitivity. Another disadvantage of this test is the need of specific infrastructure. Labeled urea can be costly and needs an additional clinic visit for testing. These factors make the test more expensive than antibody or fecal antigen test.

The fecal antigen test identifies bacteria antigen in stool. As this provides evidence of ongoing infection, the test can be used as a screening test as well as a test for eradication. Sensitivity and specificity varies between tests.

In general, testing to document *H. pylori* eradication after treatment, or test of cure, should be performed at least 4 weeks after the completion of therapy. Since it is not practical to test everyone, the American College of Gastroenterology recommends considering testing the following groups: any individual with *H. pylori* associated ulcer, individuals with persistent dyspeptic symptoms, those with *H. pylori* associated MALT lymphoma and individuals who have undergone resection of early gastric cancer.¹

GOALS OF TREATMENT

The eradication of *H.pylori* has revolutionized the course of peptic ulcer disease. The current treatment is successful in approximately 80% of patients. Several studies have indicated that relapse rates for duodenal and gastric ulcers are high, but is significantly reduced by *H.pylori* treatment.⁸ This is because curing *H.pylori* not only heals the ulcerated lesions but alters the course of PUD. When treating *H.pylori*, the first course of therapy has the greatest likelihood of eradicating the infection. With each subsequent treatment (i.e if the patient has been exposed to the antibiotics in the treatment regimen or if the same antibiotic regimen was used previously), the likelihood to eradicate *H.pylori* is less probable. Therefore, it is essential to evaluate the best option for the individual patient based on tolerability, cure rate, safety, drug interaction potential and convenience of administration of the regimen.

FIRST-LINE TREATMENT

In the United States, the first-line treatments include either a **clarithromycin based therapy** or **bismuth quadruple therapy**. The **clarithromycin based therapy** includes a proton pump inhibitor (given twice daily), clarithromycin and amoxicillin given for ten to fourteen days. Metronidazole may be substituted for amoxicillin in penicillin allergic patients. The **bismuth quadruple therapy** includes a PPI or a histamine-2 receptor antagonist (H2RA), bismuth, metronidazole and tetracycline. See Table A. These regimens have shown eradication rates ranging from 70 to 80% in clinical trials. The treatment duration of 10 -14 days is considered standard of care in the United States, but in other countries shorter durations are used. In a recent meta-analysis including 900 patients, it was found that a 14-day course had better eradication rates than a shorter 7-day course. These results have been confirmed by a large trial conducted in Italy. Because in the United States eradication rates can be as low as 70% to 75%, the American College of Gastroenterology recommends maximizing the *H.pylori* treatment for at least 10 days. The FDA-approved treatment regimens for *H.pylori* eradication are provided in Table B.

The different PPIs have performed comparably when used in these regimens, but twice daily dosing of the PPI helps improve outcomes compared to the once daily dosing. See Table A. It also appears that a H2RA can be substituted if the patient cannot tolerate a PPI.

The bismuth quadruple therapy is the alternative to the clarithromycin based regimen with similar eradication rates. This may be considered in areas of *H.pylori* resistance. The criticisms of the bismuth quadruple regimen include: high pill burden, frequent dosing and the perceived side effects. The frequency of moderate or severe side effects are similar between the clarithromycin based therapy and bismuth quadruple therapy in clinical trials.

The American College of Gastroenterology recommends the clarithromycin based therapy (which includes clarithromycin, amoxicillin and a PPI) for patients who have not received clarithromycin previously and for those who do not have a penicillin allergy. In patients with a penicillin allergy, metronidazole may be substituted for amoxicillin. The bismuth quadruple therapy should be considered in patients with a penicillin allergy or patients who have previously been treated with a macrolide.

TREATMENT FAILURES

The two most important predictors of treatment failure are poor treatment adherence and antibiotic resistance. It is vital that pharmacists counsel patients to take the *H. pylori* regimens exactly as prescribed in order to reduce the likelihood of treatment failure and development of resistance. In addition, it is important for pharmacists to inform patients about the most common side effects with these regimens. Up to 10% of patients report headache and diarrhea when taking PPIs. The PPIs should be administered 30 to 60 minutes before eating to maximize acid suppression. The most common side effects with clarithromycin include GI upset, diarrhea and altered taste. Similarly, the most common side effects related to amoxicillin include GI upset, headache and diarrhea. The side effects related to metronidazole include a metallic taste, dyspepsia and disulfiram-like reaction with alcohol intake. The most common side effects of tetracycline include GI upset and photosensitivity. The bismuth compounds are associated with darkening of the tongue and stool, nausea and GI upset. Informing patients about the anticipated side effects may reduce the likelihood of patients needlessly stopping therapy. See Table E for more information.

ANTIBIOTIC RESISTANCE

Antibiotic resistance must be considered when selecting an *H. pylori* regimen. The *Helicobacter pylori* Antimicrobial Resistance Monitoring Project (HARP) is a prospective surveillance study that tracks the regional trends of antimicrobial resistance in *H. pylori* isolates in the United States. Among *H. pylori* isolates from 1998 to 2002, 34% were resistant to 1 or more antimicrobial agent, while 29% of *H. pylori* isolates were resistant to one agent only. Only 1% of the isolates were resistant to amoxicillin, but 13% of them were resistant to clarithromycin. Twenty-five percent were resistant to metronidazole, and none was found to be resistant to tetracycline. There was not a significant trend for resistance to metronidazole, but a significant trend was noted for a decline in resistance to clarithromycin during the four year study period. The *H. pylori* isolates from the Northeast region had the highest frequency of single and dual agent resistance. See Table D. The Midwest region had the second highest single agent resistance rate, while the southern region had the second highest dual agent resistance rate. From this study, African Americans were associated with *H. pylori* resistance.

In another study, it was found that previous treatment with either clarithromycin or metronidazole for any indication increased the risk of *H. pylori* resistance to these antibiotics. Clinicians are encouraged to consider using the bismuth containing regimen in these patients. Unfortunately, unlike other bacteria, cultures and susceptibilities of *H. pylori* are typically not performed due to lack of availability and expense.

SALVAGE TREATMENTS

There are several salvage regimens that can be used in these circumstances including a levofloxacin based regimen or a rifabutin based regimen. If the clarithromycin based regimen was used initially, then the bismuth quadruple therapy can be used as salvage. See Table C. The studies evaluating these regimens have been small but promising. The salvage rifabutin study included patients who had failed therapy with the clarithromycin.¹⁰ They were treated with rifabutin 150mg daily, pantoprazole 80mg three times daily and amoxicillin 1g to 1.5 g three times daily for a duration of 12 days. The eradication rate was 91%. The presence of clarithromycin or metronidazole resistance did not decrease the likelihood of success. Forty percent of patients had mild side effects including diarrhea, nausea, abdominal pain, thrush and headache.

A levofloxacin salvage trial also evaluated patients who had previously failed the clarithromycin based therapy in Taiwan.¹¹ The regimens that were compared were lansoprazole 30mg twice daily and amoxicillin 1g twice daily with either levofloxacin 500mg once daily vs. levofloxacin 500mg twice daily for 7 days. The eradication rates ranged from 80 to 87% in both groups. The levofloxacin twice daily group had slightly higher rates of mild side effects, but this was not statistically significant. There are similar trials evaluating the use of levofloxacin in this setting around the world, but not in the United States. The American College of Gastroenterology does not recommend routine use in the United States because this regimen has not been evaluated in this country, and the resistance rates to levofloxacin are unknown. Although, they state that the levofloxacin based regimen may be reasonable in cases where clarithromycin or bismuth based treatment cannot be used.

CONCLUSION

H. pylori is a prevalent, world-wide, chronic infection that remains linked to the development of peptic ulcer disease, gastric malignancies and dyspeptic symptoms. The methods for *H. pylori* testing can be separated between invasive and non-invasive techniques with no single test being sufficient to make a diagnosis. The American College of Gastroenterology recommends that the first-line treatment includes either a clarithromycin based regimen or bismuth based regimen. The eradication rates with the clarithromycin based regimen are decreasing due to increased amount of clarithromycin resistance. Because the cure rates are dependent on adherence to the treatment regimen prescribed, the involvement of a pharmacist in counseling the patient on treatment goals and side effects is imperative to successful eradication of *H. pylori*.

Table A: First-line Treatment Regimens for *H. pylori* infection Recommended by American College of Gastroenterology¹

Regimen	Duration	Eradication Rates	Comments
1. Standard PPI BID* 2. clarithromycin 500mg po BID 3. amoxicillin 1000mg po BID (or metronidazole 500mg po BID)	10-14 days	70-85%	Use metronidazole instead of amoxicillin in pts with penicillin allergy or who have received a macrolide previously
1. Bismuth subsalicylate 525mg po QID 2. metronidazole 250mg po QID 3. tetracycline 500mg po QID 4. ranitidine 150mg po BID or standard PPI daily or BID	10-14 days	75-90%	

*Standard dosages of PPIs are: lansoprazole 30mg po BID, omeprazole 20mg po BID, pantoprazole 40mg po BID, rabeprazole 20mg po BID, esomeprazole is daily

Table B: FDA-approved regimens for *H. pylori* eradication

1. bismuth 525mg QID + metronidazole 250mg QID + tetracycline 500mg po QID x 2 weeks & H2RA as directed for 4 weeks
2. Lansoprazole 30mg BID + clarithromycin 500mg BID + amoxicillin 1g BID x 10 days*
3. Omeprazole 20mg BID + clarithromycin 500mg BID + amoxicillin 1g BID x 10 days
4. esomeprazole 40mg daily + clarithromycin 500mg BID + amoxicillin 1g BID x 10 days
5. Rabeprazole 20mg BID + clarithromycin 500mg BID + amoxicillin 1g BID x 10 days

* Available as PreVPak ® which contains all three medications in a packet

Table C: Therapy for Persistent *H. pylori*^{1, 10}

Regimen	Duration	Eradication Rate	Comments
PPI daily, tetracycline, Pepto Bismol, metronidazole qid	7 days	68%	Doses vary based on study
PPI, amoxicillin 1g BID, levofloxacin 500mg daily	10 days	87%	Needs validation in the United States.
Rifabutin 150mg daily, pantoprazole 80mg TID & amoxicillin 1g or 1.5 g TID	12 days	91%	Outcomes not reduced by presence of antibiotic resistance

Table D: *H. pylori* resistance based on region⁹

Region	No. isolates	Resistant to 1 agent No. (%)	Resistant to >1 agent No. (%)	Resistant to >1 agent No. (%)
Northeast	156	54 (35)	9 (6)	63 (40)
South	92	19 (21)	4 (4)	23 (25)
West	24	3 (13)	1 (4)	4 (17)
Midwest	75	25 (33)	3 (4)	28 (37)
Total	347	101	17	118

Table E. Counseling points for first-line *H. pylori* treatment^{12,13,14,15,16, 17}

Drug	Dose	Counseling points	Drug Interaction potential
clarithromycin	500mg po BID	<ul style="list-style-type: none"> -Take with or without food -Most common side effects: diarrhea, nausea, abnormal taste, dyspepsia, abdominal pain/discomfort and headache -Pregnancy category C 	<ul style="list-style-type: none"> -Cytochrome P450 3A4 substrate & inhibitor. -Drugs metabolized by this pathway may be affected. -Examples: HMG CoA reductase inhibitors, carbamazepine, sildenafil, quinidine, tacrolimus, cyclosporine, etc -Contraindicated drugs: cisapride, pimozone, astemizole, terfenadine, ergotamine or dihydroergotamine
Amoxicillin	1000mg po BID	<ul style="list-style-type: none"> -Take with or without food -Most common side effects: diarrhea, nausea and vomiting -Discuss signs/symptoms of allergic reaction -Pregnancy category B 	<ul style="list-style-type: none"> -Probenecid may increase amoxicillin concentrations -Progesterone/estrogen contraceptives may have decreased efficacy
*Lansoprazole See Table A for list of all PPIs	30mg po BID	<ul style="list-style-type: none"> -Take 30 to 60 minutes prior to meals -Most common side effects: headache, diarrhea -Pregnancy category B 	<ul style="list-style-type: none"> -Substrate of Cytochrome P450 3A4 & 2C19 but fewer interactions seen -Sucralfate reduces bioavailability of PPI take PPI 30 min prior to sucralfate -Medications that gastric pH is an important factor for bioavailability may have altered absorption (ketoconazole, itraconazole, ampicillin, iron salts, digoxin, cefpodoxime and atazanavir)
Bismuth subsalicylate	525mg po QID	<ul style="list-style-type: none"> - Most common side effects: darken tongue and/or stools -Several dosage forms available (liquid, caplets and chewable tablets) - Not suitable for children < 12 years old 	<ul style="list-style-type: none"> -Take with or without food -Doxycycline (or tetracycline) should be taken at least two to three hours before the bismuth subsalicylate dose. -Interacts with warfarin possibly increasing risk of bleeding

Drug	Dose	Counseling points	Drug Interaction potential
Metronidazole	250mg po QID	<ul style="list-style-type: none"> - most common side effects: nausea, vomiting, headache, anorexia, unpleasant metallic taste- - Rare side effects: seizures, peripheral neuropathy -Do not use in first trimester of pregnancy 	<ul style="list-style-type: none"> - Avoid alcohol during treatment (at least one day afterwards) due to disulfiram-like reaction - Interacts with warfarin, prolonging prothrombin time - Phenytoin may increase clearance of metronidazole -Avoid ergotamine & similar products
Tetracycline	500mg po QID	<ul style="list-style-type: none"> - Most common side effects photosensitivity, diarrhea, nausea, vomiting - Pregnancy category D - Do not give to children < 8 years old 	<ul style="list-style-type: none"> - Aluminum, calcium or magnesium containing products may impair the absorption of orally administered tetracyclines & separate by 1-2 hours - May interact with digoxin & estrogen/progesterone contraceptives
Ranitidine	150mg po BID	<ul style="list-style-type: none"> - Most common side effects: nausea, vomiting, diarrhea, dizziness, headache, constipation, - Pregnancy category B 	<ul style="list-style-type: none"> - Medications that gastric pH is an important factor for bioavailability may have altered absorption (ketoconazole, itraconazole, ampicillin, iron salts, digoxin & cefpodoxime)

* See prescribing information for other PPIs for specific information related side effects and drug interactions.

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1. Does the program meet the learning objectives?

Discuss management of <i>H.pylori</i> infection	Yes	No
Differentiate between invasive & noninvasive tests for <i>H.pylori</i> infection	Yes	No
List treatment options for <i>H.pylori</i> infection	Yes	No
Discuss antibiotic resistance as related to treating <i>H.pylori</i>	Yes	No

2. Was the program independent & non-commercial

	Yes	No
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3. Relevance of topic

	Poor		Average		Excellent
	1 2	3	4 5	6	7

4. What did you like most about this lesson? _____

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| <ol style="list-style-type: none"> 1. Infection with <i>H.pylori</i> has been linked as the cause of: <ol style="list-style-type: none"> A. Peptic Ulcer Disease B. Chronic gastritis C. MALT lymphoma D. All of these 2. Testing for <i>H.pylori</i> in patients with uninvestigated dyspepsia is recommended <ol style="list-style-type: none"> A. For all patients with dyspepsia B. Only in areas of high <i>H.pylori</i> prevalence C. Patients with dyspepsia & GERD D. None of these 3. An example of an invasive technique for <i>H.pylori</i> testing is: <ol style="list-style-type: none"> A. Antibody testing B. Urea Breath Test (UBT) C. Endoscopy D. Fecal antigen testing 4. The sensitivity of many of the tests for <i>H.pylori</i> diminishes if patients take <ol style="list-style-type: none"> A. Multivitamins B. Iron supplements C. Aspirin D. Proton Pump Inhibitors 5. In a penicillin-allergic patient, which 1st line treatment would you recommend? <ol style="list-style-type: none"> A. Bismuth+metronidazole+tetracycline+lansoprazole B. Amoxicillin+clarithromycin+lansoprazole C. Levofloxacin+rifabutin+lansoprazole D. None of these | <ol style="list-style-type: none"> 6. What are the 1st line treatment options for <i>H.pylori</i> infection? <ol style="list-style-type: none"> A. Clarithromycin based regimen B. Bismuth based quadruple regimen C. Levofloxacin based regimen D. A & B 7. What is the appropriate duration of treatment for <i>H.pylori</i> in the U.S.? <ol style="list-style-type: none"> A. 10 – 14 days B. 5 – 7 days C. 7 days D. 4 weeks 8. Which test does not provide evidence of active infection? <ol style="list-style-type: none"> A. Antibody testing B. Fecal antigen testing C. Urea Breath Testing (UBT) D. Rapid Urease Testing (RUT) 9. Which region in the U.S. had the highest rate of single & dual agent <i>H.pylori</i> resistance? <ol style="list-style-type: none"> A. Northwest B. Southwest C. Northeast D. Midwest 10. What are the two most important predictors of <i>H.pylori</i> treatment failure? <ol style="list-style-type: none"> A. Patient compliance & antibiotic resistance B. Smoking & alcohol consumption C. Diet & patient compliance D. None of these |
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