Digestion Case Studies

Write out all questions and answers on a separate sheet of paper

Case #1

Harold, a fifty-eight year old grocery store manager, had recently been waking up in the middle of the night with abdominal pain. This was happening several nights a week. He was also experiencing occasional discomfort in the middle of the afternoon. Harold decided to schedule an appointment with his physician.

The doctor listened as Harold described his symptoms and then asked Harold some questions. He noted that Harold’s appetite had suffered as a result of the pain he was experiencing and as a result of the fear that what he was eating may be responsible for the pain. Otherwise, Harold seemed fine.

The doctor referred Harold to a physician that specialized in internal medicine and had Harold make an appointment for a procedure called an endoscopy. The endoscopy was performed at a hospital later that week. During the procedure, a long, thin tube was inserted into Harold’s mouth and directed into his digestive tract. The end of the tube was equipped with a light source and a small camera which allowed the doctor to observe the interior of Harold’s stomach. The endoscope was also equipped with a small claw-like structure that the doctor could use in order to obtain a small tissue sample from the lining of Harold’s stomach, if required.

The endoscopy revealed that Harold had a peptic ulcer. Analysis of a tissue sample taken from the site showed that Harold also had an infection that was caused by Helicobacter pylori bacteria. The doctor who performed the endoscopy gave Harold prescriptions for two different antibiotics and a medication that would decrease the secretion of stomach acid. The doctor also instructed Harold to schedule an appointment for another endoscopy procedure in 6 months.

Case Background

A peptic ulcer is a sore that occurs in the lining of a part of the gastrointestinal tract that is exposed to pepsin and acid secretions. Most peptic ulcers occur in the lining of the stomach or duodenum. 90% of all duodenal ulcers and 80% of all gastric ulcers are caused by H. pylori infection. Most of the remaining peptic ulcers are caused by long-term usage of certain anti-inflammatory medications like aspirin.

There is still some question as to how H. pylori is spread. However, H. pylori has been identified in the saliva of infected individuals and may be spread via this fluid. H. pylori bacteria have the ability to survive the acid environment in the stomach because they produce enzymes that neutralize stomach acids. They also have the ability to move through the mucous membrane lining the stomach or duodenum and take up residence in the underlying connective tissue. The damage to the mucous membrane that results from a H. pylori infection allows pepsin and hydrochloric acid to further damage the wall of the stomach or duodenum. The sore that results is the peptic ulcer.

Answer the following questions about this case

1. Describe the functions of the following components of gastric juice.
   a. Hydrochloric acid –
   b. Pepsinogen –
   c. Pepsin –
   d. Intrinsic factor –

2. Why don’t the components of gastric juice damage the wall of the stomach in the absence of a H. pylori infection?

3. Why don’t most other types of bacteria produce ulcers?
Case #2: The Case of the Missionary Health Care Worker in Africa

Jenny, a twenty-two year old college graduate, has recently decided to spend two years as a missionary in a coastal African village. As part of her duties, she will work in the missionary clinic that has recently been established in the village. This clinic will provide routine medical care and a traveling physician and nurse will visit once each week. Jenny feels fortunate to have the opportunity to use the information that was presented to her in various classes she completed while in college. After completing a 4-month intensive training period (language classes, medical preparation for work in the clinic, and cultural enrichment), she departed for Africa.

Upon her arrival, Jenny found that she would be spending most of her time in the clinic since the village had been without routine medical care for the past 2 years. The previous clinic was closed due to flooding and insufficient funds to rebuild. Initially, Jenny found that she was very dependent upon the physician’s weekly visits since her training was limited. Gradually, she found that she was beginning to call upon her training (both clinical and classroom) and she felt comfortable diagnosing and treating some of the more routine cases. One morning, a mother came in with her five-year-old child. The mother reported that the child had been unable to eat or drink anything for the past day because of vomiting. In addition, her child was experiencing severe diarrhea. Jenny’s first thought was that the symptoms were very similar to those she had exhibited following a bout of food poisoning while in college. Since the villagers had no refrigeration and poor sanitation, Jenny gave the mother an electrolyte solution containing glucose similar to Gatorade® and told the mother to have the affected children consume this solution and nothing else for the next 24 hours. After that time, if the children were no longer vomiting, she could start feeding them tea and broth. Jenny also cautioned the mother that if the children did not seem to be getting better after 24 hours to bring the children back to the clinic.

The next morning Jenny opened the clinic to find the mother, and not just the child she had seen the previous day, but three more of the woman’s children. All of the children were exhibiting similar symptoms that now included muscle cramping and excessive thirst in addition to diarrhea and vomiting. When checking the vital signs of the children, Jenny noticed increases in both the pulse and respiratory rates accompanied by decreased blood pressures. Uncertain as to the appropriate course of action, Jenny contacted the physician by radio. Upon conveying the histories and information to the physician, Jenny received instructions to keep the children at the clinic, start intravenous (IV) infusion with lactated Ringer’s solution, and allow the children to drink as much of the electrolyte solution with glucose as they would like. The physician also gave Jenny a list of laboratory tests to run on the blood, urine and stool samples that she should collect. Jenny started the IV infusions and gave each child some of the electrolyte solution. After this, she obtained stool, blood and urine samples from each child and asked the mother to leave the children with her for care and observation. The mother agreed and said she would return later that night to help with the children.

The results of the tests run indicated severe metabolic acidosis, an increased hematocrit, hypokalemia, and the presence of Vibrio cholerae bacteria in the stool samples. Based on the results of these tests, the physician and Jenny diagnosed the children with cholera and obtained a more detailed history in an attempt to determine whether these individuals were the only ones exposed or whether these cases were the first of a possible epidemic. Jenny and the physician found that the family had recently visited relatives in a distant village where similar symptoms had been present in a number of families that had all celebrated a recent shellfish harvest.

The physician prescribed continued IV infusions with lactated Ringer’s solution and electrolyte fluid replacement by mouth. The children were not allowed to consume other foods or drinks, especially coffee or any other beverages containing caffeine. The children were also told that once the vomiting stopped they could start consuming solid foods. The children were all treated with antibiotics and stool samples were taken from other family members to determine whether or not they were infected with Vibrio cholerae. Infected, asymptomatic individuals were treated with antibiotics. The physician later explained to Jenny that caffeine was prohibited because the toxin produced by the bacteria (termed choleragen) binds to the surface of the epithelial cells of the small intestine and activates adenylate cyclase. In addition, the toxin interferes with the active transport of sodium ions in the intestinal lumen.
**Answer the following questions about this case**

4. Why did Jenny initially suspect that the child and the other family members were experiencing food poisoning?
5. Why did Jenny initially prescribe an electrolyte solution containing glucose?
6. Upon further evaluation on the second day why would the children present with an increased pulse and respiratory rate but a decreased blood pressure?
7. Why did the children present with metabolic acidosis?
8. Why were the children experiencing muscle cramping and complaining of excessive thirst on the second day?
9. Why were the children not allowed to consume any caffeine containing beverages?
10. Why does the effect of the cholera toxin on the epithelial sodium transport protein contribute to both the diarrhea and metabolic acidosis?

**Case #3**

Steve was a 21-year-old male college student who complained of pain, nausea with vomiting, and tenderness in the right lower quadrant. The pain was first vague and diffuse, then became more severe in the midepigastric region before localizing in the right lower quadrant. The pain was accentuated by movement, deep respiration, coughing, or sneezing. A mild fever of 102.2° F and a moderate leucocytosis (11,500/cu mm) were present. A marked tenderness was noted over the right lower quadrant at McBurney's point (one-third the distance between the anterior superior iliac spine and the umbilicus). The psoas sign (pain on passive hyperextension of the thigh) was also present. His vitals were:

Temperature 102.2° F  
Pulse 96  
BP 140/90  
Respiration 18 b/min and shallow

His abdomen was protuberant with decreased bowel sounds. The abdominal x-ray indicated distended bowel loops.

11. What is the diagnosis of this individual?
12. Describe in anatomical terms the location of the organ involved.
13. Locate the midepigastric region and McBurney's point on yourself. Describe these locations below.
14. What is the cause of the fever, pain, and leukocytosis in this person?
15. What is the usual treatment of this disorder?
Case #4

A 26-year-old business executive complained of a dull pain (heartburn) behind the sternum. The pain was postprandial (occurred after meals) and disappeared within a few minutes to an hour. It was often associated with belching and often was worse on lying down or on exertion after heavy meals. Sometimes it radiated to the back, jaws, shoulders, and down the inner aspects of the arms, simulating angina pectoris. X-rays revealed a small portion of the stomach above the diaphragm, and an endoscopic biopsy revealed mucosal inflammation. Esophageal manometry (determining pressures at the lower esophageal sphincter, LES) revealed decreased LES pressure. Esophageal pH monitoring showed reflux of gastric contents into the esophagus and provided direct evidence of gastroesophageal reflux. Recommended treatment for this individual is avoidance of strong stimulants of gastric acid secretion (e.g., coffee, alcohol) and avoidance of certain drugs (e.g., anticholinergics), and specific foods (fats, chocolates, whole milk, and orange juice), and smoking, all of which reduce LES competence. Elevation of the head of the bed by about six inches is also recommended. Suggested treatments also include the use of cholinergic agonists (e.g., bethanechol) and the use of histamine (H2) antagonists (cimetidine).

16. What is the disorder of this 26-year-old business executive? Explain.
17. What mechanisms normally prevent gastric reflux into the esophagus when lying down or bending over?
18. Why are anticholinergic agents avoided and cholinergic agonists recommended in the treatment of gastroesophageal reflux?
19. Why are histamine (H2) antagonists recommended?
20. Why is elevation of the head of the bed recommended?
21. What is the normal pH of the esophagus? Of the stomach?
22. Predict values for the gastroesophageal patient in this case for lower esophageal and stomach pH.