

McCance: Pathophysiology, 6th Edition

Chapter 39: Alterations of Digestive Function

Key Points – Print

SUMMARY REVIEW

Disorders of the Gastrointestinal Tract

1. Anorexia (loss of appetite), vomiting, constipation, diarrhea, abdominal pain, and evidence of gastrointestinal bleeding are clinical manifestations of many disorders of the gastrointestinal tract.
2. Vomiting is the forceful emptying of the stomach effected by gastrointestinal contraction and reverse peristalsis of the esophagus. It is usually preceded by nausea and retching with the exception of projectile vomiting, which is associated with direct stimulation of the vomiting center in the brain.
3. Constipation is often caused by unhealthy dietary and bowel habits combined with lack of exercise. Constipation also can result from a neurogenic disorder, a disorder that impairs intestinal motility, or a disorder that obstructs the intestinal lumen.
4. Diarrhea can be caused by excessive fluid drawn into the intestinal lumen by osmosis (osmotic diarrhea), excessive secretion of fluids by the intestinal mucosa (secretory diarrhea), or excessive gastrointestinal motility.
5. Abdominal pain is caused by stretching, inflammation, or ischemia. Abdominal pain originates in the organs themselves (visceral pain) or in the peritoneum (parietal pain). Visceral pain is often referred to the back.
6. Gastrointestinal bleeding can occur in the upper or lower gastrointestinal tract. Obvious manifestations of gastrointestinal bleeding are hematemesis (vomiting of blood), melena (dark, tarry stools), and hematochezia (frank bleeding from the rectum). Occult bleeding can be detected only by testing stools or vomitus for the presence of blood.
7. Dysphagia is difficulty in swallowing. It can be caused by a mechanical or functional obstruction of the esophagus. Functional obstruction is an impairment of esophageal motility.
8. Achalasia is a form of functional dysphagia caused by loss of esophageal innervation or relaxation of the lower esophageal sphincter.
9. Gastroesophageal reflux is the regurgitation of chyme from the stomach into the esophagus. An inflammatory response (reflux esophagitis) ensues if the esophageal mucosa is repeatedly exposed to acids and enzymes in the regurgitated chyme.
10. Hiatal hernia is the protrusion of the upper part of the stomach through the hiatus (esophageal opening in the diaphragm) at the gastroesophageal junction. Hiatal hernia can be sliding or paraesophageal.

11. Pyloric obstruction is the narrowing or blockage of the pylorus, which is the opening between the stomach and the duodenum. It can be caused by a congenital defect, inflammation and scarring secondary to a gastric ulcer, or tumor growth.
12. Intestinal obstruction prevents the normal movement of chyme through the intestinal tract. It is usually mechanical—that is, caused by torsion, herniation, or tumor. Functional obstruction is caused by paralytic ileus.
13. The most severe consequences of intestinal obstruction are fluid and electrolyte losses, hypovolemia, shock, intestinal necrosis, and perforation of the intestinal wall.
14. Gastritis is an acute or a chronic inflammation of the gastric mucosa.
15. Regurgitation of bile, use of anti-inflammatory drugs or alcohol, *H. pylori* infection, and some systemic diseases are associated with gastritis.
16. Chronic fundal gastritis is rare and associated with autoantibodies to parietal cells and intrinsic factor resulting in gastric atrophy and pernicious anemia.
17. Chronic antral gastritis is the most common and is associated with *H. pylori* and NSAIDs.
18. A peptic ulcer is a circumscribed area of mucosal inflammation and ulceration caused by excessive secretion of gastric acid, disruption of the protective mucosal barrier, or both.
19. The three types of peptic ulcers are duodenal, gastric, and stress ulcers and they are usually caused by *H. pylori* infection or NSAIDs.
20. Duodenal ulcers, the most common peptic ulcers, are associated with increased numbers of parietal (acid-secreting) cells in the stomach, elevated gastrin levels, and rapid gastric emptying. Pain occurs when the stomach is empty, and pain is relieved with food or antacids. Duodenal ulcers tend to heal spontaneously and recur frequently.
21. Gastric ulcers develop near parietal cells, generally in the antrum, and tend to become chronic. Gastric secretions may be normal or decreased, and pain may occur after eating.
22. Zollinger-Ellison syndrome is associated with a gastrinoma, chronic secretion of gastric acid, and gastric and duodenal ulcers.
23. Ischemic stress ulcers develop suddenly after severe illness, systemic trauma, or neural injury. Ulceration follows mucosal damage caused by ischemia (decreased blood flow to the gastric mucosa).
24. Cushing ulcer is a stress ulcer caused by head trauma. Ulceration follows hypersecretion of hydrochloric acid caused by overstimulation of the vagal nuclei.
25. Postgastrectomy syndromes are long-term complications that follow gastrectomy—the resection of all or part of the stomach. The postgastrectomy syndromes include dumping syndrome, alkaline reflux gastritis, afferent loop obstruction, diarrhea, weight loss, and anemia.
26. Dumping syndrome is the rapid emptying of hypertonic chyme from the surgically created residual stomach into the small intestine. It causes an osmotic shift of fluid from the vascular compartment to the intestinal lumen, which decreases plasma volume.

27. Alkaline reflux gastritis is stomach inflammation caused by the reflux of bile and pancreatic secretions from the duodenum into the stomach. These substances disrupt the mucosal barrier and cause inflammation.
28. Afferent loop obstruction is an obstruction of the duodenal stump on the proximal side of a gastrojejunostomy. Biliary and pancreatic secretions accumulate in the stump, causing distention, intermittent pain, and vomiting.
29. Malabsorption syndromes result in impaired digestion or absorption of nutrients.
30. Pancreatic insufficiency causes malabsorption associated with insufficient amounts of the enzymes that digest protein, carbohydrates, and fats into components that can be absorbed by the intestine.
31. Deficient lactase production in the brush border of the small intestine inhibits the breakdown of lactose. This prevents lactose absorption and causes osmotic diarrhea.
32. Bile salt deficiency causes fat malabsorption, including fat soluble vitamins, and steatorrhea (fatty stools). Bile salt deficiency can result from inadequate secretion of bile, excessive bacterial deconjugation of bile, or impaired reabsorption of bile salts caused by ileal disease.
33. Ulcerative colitis is an inflammatory disease that causes ulceration, abscess formation, and necrosis of the colonic and rectal mucosa. Cramping pain, bleeding, frequent diarrhea, dehydration, and weight loss accompany severe forms of the disease. A course of frequent remissions and exacerbations is common.
34. Crohn disease is similar to ulcerative colitis, but it affects the large and small intestines, and ulceration tends to involve all the layers of the lumen. “Skip lesion” fissures and granulomas are characteristic of Crohn disease. Abdominal tenderness, nonbloody diarrhea, and weight loss are the usual symptoms.
35. Diverticula are outpouchings of colonic mucosa through the muscle layers of the colon wall. Diverticulosis is the presence of these outpouchings; diverticulitis is inflammation of the diverticula.
36. Appendicitis is the most common surgical emergency of the abdomen. Obstruction of the lumen leads to increased pressure, ischemia, and inflammation of the appendix. Without surgical resection, inflammation may progress to gangrene, perforation, and peritonitis.
37. Vascular insufficiency in the intestine is associated most often with acute or chronic occlusion or obstruction of the mesenteric vessels or insufficient arterial blood flow. The resulting ischemia and necrosis produce abdominal pain, fever, bloody diarrhea, hypovolemia, and shock.
38. Obesity is defined as a BMI greater than 30 from energy intake exceeding expenditure.
39. Single gene and polygenetic disorders are associated with obesity, as well as social, cultural, economic, exercise, and metabolic factors.
40. Increases in body fat mass are associated with increases in the adipokines leptin and resistin, as well as other hormones including insulin, ghrelin, and PYY. Adiponectin is decreased. Obesity may be associated with alterations in the expression and action of peripheral

hormones and neurotransmitters that affect appetite and metabolic rate at the level of the hypothalamus.

41. Anorexia nervosa, or self-imposed starvation, is a psychogenic disorder primarily of adolescent and young women. It causes significant weight loss and developmental delays and can be fatal.
42. Bulimia nervosa (binge eating and purging) involves eating normal or large amounts of food and then purging by inducing vomiting or abusing laxatives. Severe weight loss is rare, but frequent vomiting causes tooth decay, pharyngitis, and esophagitis.
43. Short-term starvation, or lack of dietary intake for 3 or 4 days, stimulates mobilization of stored glucose by two metabolic processes: glycogenolysis (splitting of glycogen into glucose) and gluconeogenesis (formation of glucose from noncarbohydrate molecules).
44. Long-term starvation triggers the breakdown of ketone bodies and fatty acids. Eventually proteolysis (protein breakdown) begins, and death ensues if nutrition is not restored.

Disorders of the Accessory Organs of Digestion

1. Portal hypertension, ascites, hepatic encephalopathy, jaundice, and hepatorenal syndrome are complications of many liver disorders.
2. Portal hypertension is an elevation of portal venous pressure to at least 10 mmHg. It is caused by increased resistance to venous flow in the portal vein and its tributaries, including the sinusoids and hepatic vein.
3. Portal hypertension is the most serious complication of liver disease because it can cause fatal complications, such as bleeding varices, ascites, hepatic encephalopathy, and renal failure.
4. Hepatopulmonary syndrome is pulmonary hypertension associated with the release of vasodilators that effect pulmonary arterioles and is associated with portal hypertension and severe liver disease.
5. Splenomegaly is an enlargement of the spleen caused by increased splenic vein pressure caused by portal hypertension.
6. Ascites is the accumulation and sequestration of fluid in the peritoneal cavity, often as a result of portal hypertension, decreased concentrations of plasma proteins, and sodium retention.
7. Hepatic encephalopathy (portosystemic encephalopathy) is impaired cerebral function caused by blood-borne toxins (particularly ammonia) not metabolized by the liver.
8. Jaundice (icterus) is a yellow or greenish pigmentation of the skin or sclera of the eyes caused by increases in plasma bilirubin concentration (hyperbilirubinemia).
9. Obstructive jaundice is caused by obstructed bile canaliculi (intrahepatic obstructive jaundice) or obstructed bile ducts outside the liver (extrahepatic obstructive jaundice). Bilirubin accumulates proximal to sites of obstruction, enters the bloodstream, and is deposited in the skin and other connective tissues.
10. Hemolytic jaundice is caused by destruction of red blood cells at a rate that exceeds the liver's ability to metabolize unconjugated bilirubin.

11. Hepatorenal syndrome is functional kidney failure caused by advanced liver disease, particularly cirrhosis with portal hypertension. Renal failure is caused by a sudden decrease in blood flow to the kidneys, usually as a result of massive gastrointestinal hemorrhage or liver failure. Its chief clinical manifestation is oliguria.
12. Viral hepatitis is an infection of the liver caused by strains of the hepatitis virus: HAV, HBV, HCV, HDV, HEV, and HGV. HAV and HEV are transmitted via the fecal-oral route. The hepatitis viruses are blood-borne and can cause hepatic cell necrosis, Kupffer cell hyperplasia, and infiltration of liver tissue by mononuclear phagocytes. These changes obstruct bile flow and impair hepatocyte function.
13. The clinical manifestations of viral hepatitis depend on the stage of infection. Fever, malaise, anorexia, and liver enlargement and tenderness characterize the prodromal phase (stage 1). Jaundice and hyperbilirubinemia mark the icteric phase (stage 2). During the recovery phase (stage 3), symptoms resolve. Recovery takes several weeks.
14. Chronic active hepatitis can occur with HBV and HCV with predisposition to cirrhosis and hepatocellular carcinoma.
15. Fulminant hepatitis is a complication of hepatitis B (with or without hepatitis D infection) or hepatitis C. It causes widespread hepatic necrosis and is often fatal.
16. Cirrhosis is an inflammatory disease of the liver that causes disorganization of lobular structure, fibrosis, and nodular regeneration. Cirrhosis can result from hepatitis or exposure to toxins, such as acetaldehyde (a product of alcohol metabolism). The disease causes progressive irreversible liver damage, usually over a period of years.
17. Alcoholic cirrhosis impairs the hepatocytes' ability to oxidize fatty acids, synthesize enzymes and proteins, degrade hormones, and clear portal blood of ammonia and toxins. The inflammatory response includes excessive collagen formation, fibrosis, and scarring, which obstruct bile canaliculi and sinusoids. Bile obstruction causes jaundice. Vascular obstruction causes portal hypertension, shunting, and varices.
18. Primary biliary cirrhosis is an autoimmune disease with inflammatory destruction of intrahepatic bile ducts. Mitochondrial autoantibodies are found in this disease.
19. Secondary biliary cirrhosis develops from prolonged obstruction of bile flow with increased pressure in the hepatic bile ducts that causes pooling of bile and necrosis of tissue. Relief of obstruction relieves symptoms of jaundice and pruritus. Continued obstruction causes cirrhosis and liver failure.
20. Cholelithiasis (the formation of gallstones) is a common disorder of the gallbladder. Gallstones form in the bile as a result of the aggregation of cholesterol crystals (cholesterol stones) or precipitates of unconjugated bilirubin (pigmented stones). Gallstones that fill the gallbladder or obstruct the cystic, or common, bile duct cause abdominal pain and jaundice.
21. Cholecystitis is an inflammation of the gallbladder. It is usually associated with obstruction of the cystic duct by gallstones.
22. Acute pancreatitis (pancreatic inflammation) is a serious but relatively rare disorder associated with biliary obstruction and alcoholism. Injury permits leakage of digestive enzymes into pancreatic tissue, where they become activated and begin the process of

autodigestion, inflammation, and destruction of tissues. Release of pancreatic enzymes into the bloodstream or abdominal cavity causes damage to other organs.

23. Chronic pancreatitis results from structural or functional impairment of the pancreas usually related to alcoholism. It causes recurrent abdominal pain and digestive disorders.

Cancer of the Digestive System

1. Cancer of the esophagus is rare and tends to occur in people older than 60 years. Alcohol and tobacco use, reflux esophagitis, radiation exposure, and nutritional deficiencies are associated with esophageal carcinoma.
2. Dysphagia and chest pain are the primary manifestations of esophageal cancer. Early treatment of tumors that have not spread into the mediastinum or lymph nodes results in a good prognosis.
3. Gastric carcinoma is associated with *H. pylori* (CagA), high salt intake, food preservatives (nitrates and nitrites), and atrophic gastritis.
4. Approximately 50% of all gastric cancers are located in the prepyloric antrum. Clinical manifestations (weight loss, upper abdominal pain, vomiting, hematemesis, anemia) develop only after the tumor has penetrated the wall of the stomach.
5. Cancer of the colon and rectum (colorectal cancer) is the second most common cancer death in the United States. Small intestinal cancers are rare. Familial adenomatous polyposis coli is an inherited form of colon cancer. Preexisting large and numerous polyps are highly associated with sporadic adenocarcinoma of the colon.
6. Tumors of the right (ascending) colon are usually large and bulky; tumors of the left (descending, sigmoid) colon develop as small button-like masses. Manifestations of colon tumors include pain, bloody stools, and change in bowel habits.
7. Rectal carcinoma is located up to 15 cm from the opening of the anus. The tumor spreads transmurally to the vagina in women or to the prostate in men.
8. Metastatic invasion of the liver is more common than primary cancer of the liver.
9. Primary liver cancers are associated with chronic liver disease (cirrhosis and hepatitis B and C). Hepatocellular carcinomas arise from the hepatocytes, whereas cholangiocellular carcinomas arise from the bile ducts. Primary liver cancer spreads to the heart, lungs, brain, kidney, and spleen through the circulation.
10. Cancer of the gallbladder is relatively rare and tends to occur in women older than 50 years. Adenocarcinoma is most common. Because clinical manifestations occur late in the disease, metastases to lymph channels have usually occurred by the time of diagnosis, and the prognosis is poor.
11. Cancer of the pancreas ranks fifth as a cause of cancer deaths. The one known risk factor is heavy cigarette smoking. Most tumors are adenocarcinomas that arise in the exocrine cells of ducts in the head, body, or tail of the pancreas. Symptoms may not be evident until the tumor has spread to surrounding tissues. Treatment is palliative, and mortality is nearly 100%.