System: Blood & Lymphoreticular and Immune : 36,48
System: Nervous Systems and Special Senses : 9,20,32,44,47
System: Musculoskeletal, Skin, & Subcutaneous Tissue : 25,26,39,49
System: Cardiovascular : 16,19,21,29,35
System: Respiratory : 23,30,33,34,46
System: Gastrointestinal : 1,2,7,11,13,14,15,22,40,41,42,43,45,50
System: Renal/Urinary and Male and Female Reproductive : 5,6,17,24,
System: Endocrine : 8,10,31
System: Multisystem Processes/Disorders, Legal/Ethical, Biostats/Epidemiology : 12,18,27,38,

1. An otherwise healthy 47-year-old woman comes to the physician because of a 2-year history of increasingly severe heartburn. Current medications are cimetidine for the past 2 years and an over-the-counter antacid as needed; neither medication has relieved the symptoms. She has smoked one pack of cigarettes daily for 20 years and drinks three to four beers daily. She is 157 cm (5 ft 2 in) tall and weighs 59 kg (130 lb); BMI is 24 kg/m^2. Vital signs are within normal limits. Scattered wheezes are heard bilaterally. Cardiac and abdominal examinations show no abnormalities. Findings on ECG are normal. A chest x-ray shows an air-fluid level posterior to the cardiac silhouette. A barium swallow shows the proximal stomach herniating through the esophageal hiatus. Which of the following is the most appropriate next step in diagnosis?

A) 24-Hour pH monitoring
B) Endoscopic ultrasonography
C) Esophageal manometry
D) Esophagogastroduodenoscopy
E) Thoracoscopy

Correct Answer: D.

Esophagogastroduodenoscopy (EGD) involves endoscopic evaluation of the esophagus, stomach, and duodenum. It is indicated for the evaluation of various gastrointestinal pathology, including mucosal neoplasms, peptic ulcers, and esophagitis, and it can be combined with techniques such as endoscopic ultrasound and endoscopic retrograde cholangiopancreatography for definitive evaluation of visceral organs and the biliary tree. This patient presents with worsening heartburn that is refractory to histamine-blocking medication and antacids. There is evidence of a sliding hiatal hernia with the proximal stomach herniated through the esophageal hiatus. There are two main types of esophageal hiatal hernias: the sliding and paraesophageal types. Paraesophageal refers to herniation of the proximal stomach through the esophageal hiatus, without superior translation of the gastroesophageal junction. This can result in obstructive symptoms and has a less pronounced impact on reflux. A sliding hiatal hernia refers to displacement of the gastroesophageal junction superiorly ('sliding'). This increases the risk for worsening heartburn given the non-anatomic location of the gastroesophageal junction, which results in altered mechanics to block gastric acid from entering the esophagus. EGD is indicated to evaluate the exact location and extent of the sliding hiatal hernia, and to evaluate the esophagus for reflux-related complications such as esophagitis, Barrett esophagus, or esophageal adenocarcinoma.

Incorrect Answers: A, B, C, and E.

24-hour pH monitoring (Choice A) is indicated for patients who demonstrate negative endoscopy findings and are being considered for an antireflux endoscopic or surgical procedure, or who demonstrate typical reflux symptoms without relief from empiric proton pump inhibitor therapy. Initial evaluation for a hiatal hernia should instead be with an EGD to delineate the extent of the hiatal hernia and any possible reflux-associated esophageal sequelae.

Endoscopic ultrasonography (Choice B) can be used for the evaluation of suspicious pancreatic masses or submucosal gastrointestinal masses, allowing for identification and tissue sampling. This would not assist in the evaluation of a hiatal hernia.

Esophageal manometry (Choice C) measures the pressure generated along the length of the esophagus and lower esophageal sphincter. It is utilized in the evaluation of suspected esophageal dysmotility disorders such as achalasia and diffuse esophageal spasm.

Thoracoscopy (Choice E) involves visualization and examination of the lung surface and pleural space through a thoracoscope. It would not provide assistance in the evaluation of a hiatal hernia.

2. A 77-year-old woman comes to the physician because of a 3-day history of nausea, vomiting, and midabdominal cramps. During the past 2 days, she has vomited within 1 hour of eating solid food. Her last bowel movement 2 days ago was normal. She usually has a bowel movement every 1 to 2 days. She has not had fever. She has type 2 diabetes mellitus. Ten years ago, she underwent an open cholecystectomy for cholecystitis. Current medications include intermediate-acting insulin, lisinopril, and aspirin. She does not smoke or drink alcohol. Her pulse is 100/min, and blood pressure is 110/70 mm Hg. Abdominal examination shows mild distention and tenderness without rebound or guarding. Bowel sounds are increased and high pitched. Laboratory studies show:

Hematocrit	45%
Leukocyte count	15,000/mm^3
Serum	
Na^+	147 mEq/L
K^+	3.5 mEq/L
Cl^-	112 mEq/L
HCO_3^-	24 mEq/L
Urea nitrogen	25 mg/dL
Creatinine	1.2 mg/dL

An x-ray of the abdomen shows dilated loops of small bowel and air-fluid levels without a clear transition zone or free air. Which of the following is the most likely diagnosis?

A) Adhesions
B) Diabetic neuropathy
C) Inguinal hernia
D) Mesenteric ischemia
E) Sigmoid volvulus

Correct Answer: A.

Adhesions are the most common cause of small bowel obstruction (SBO) in patients with a prior history of intra-abdominal surgery. Obstruction of the small bowel occurs from partial or complete blockage of the small bowel lumen and typically presents with nausea, vomiting, and abdominal pain. Partial SBO allows a degree of continued flatus with diminished stooling, and complete SBO will result in obstipation (no passage of stool or flatus). SBO has many potential etiologies, with peritoneal adhesions that form following a previous intra-abdominal surgery being the most frequent. On physical examination, SBO typically presents with abdominal tenderness, distention, tympany to percussion, and borborygmi (high-pitched, hyperactive bowel sounds). Potential complications of SBO include bowel rupture and/or necrosis, which can result in sudden-onset peritonitic abdominal signs such as rebound tenderness and guarding. Abdominal x-rays typically demonstrate multiple air-fluid levels in the setting of dilated small bowel loops. Management requires bowel rest and intravenous hydration followed by surgical intervention if the obstruction does not autoreduce. Partial SBO may resolve with monitoring, supportive care, and bowel rest, whereas complete obstruction or any complicated partial obstruction generally requires management through exploratory laparotomy.

Incorrect Answers: B, C, D, and E.

Diabetic neuropathy (Choice B) is a microvascular complication of long-standing diabetes mellitus that typically presents in a ‘stocking and glove’ distribution of the hands and feet. If associated neuropathy of the autonomic nervous system occurs, this can result in complications such as diabetic gastroparesis or dysautonomia. Gastroparesis typically presents with slowly progressive early satiety, nausea, vomiting of undigested food, and abdominal bloating with a succussion splash heard during physical examination.

Inguinal hernias (Choice C) are protrusions of abdominal contents into the inguinal region through a defect in the lower abdominal wall. Incarceration and strangulation are potential complications of inguinal hernias and may require surgical correction. Hernias are the second most common cause of SBO in patients with a prior history of intra-abdominal surgery.

Mesenteric ischemia (Choice D) can occur in acute and chronic forms. Acute mesenteric ischemic typically occurs from a critical decrease in intestinal blood flow, most commonly from thromboembolic occlusion of a mesenteric vessel (e.g., superior mesenteric artery) or a severe hypoperfusion state (e.g., hemorrhagic shock). This results in ischemia and potential necrosis of the bowel, which presents with abdominal pain out of proportion to the physical examination findings.

Sigmoid volvulus (Choice E) results from twisting of the sigmoid mesentery, which can lead to large bowel obstruction and potential rupture or necrosis if not treated. It typically demonstrates a coffee-bean appearance on abdominal x-rays.

3. A 42-year-old woman, gravida 3, para 3, comes to the physician because of a 3-month history of intermittent bloody discharge from her right nipple. Her mother died of breast cancer at the age of 60 years. On examination, bloody discharge can be expressed with pressure on the right areola. No masses are palpable. Palpation of the left breast and axilla shows no abnormalities. Mammography shows normal findings. Which of the following is the most likely diagnosis?

A) Breast abscess
B) Breast cancer
C) Cystosarcoma phyllodes
D) Galactocele
E) Hematoma
F) Inflammatory carcinoma of the breast
G) Intraductal papilloma
H) Sebaceous cyst

Correct Answer: G.

Intraductal papilloma is the most common cause of unilateral bloody nipple discharge. Nipple discharge is concerning for underlying malignant pathology if presenting as spontaneous bloody, serosanguinous, or clear unilateral discharge or if there is discharge in the setting of a palpable breast mass. Intraductal papillomas are benign tumors originating from the walls of milk ducts that typically grow and can result in local duct obstruction. Papillomas can be solitary or multiple, and while typically benign, can contain areas of atypia or carcinoma. Mammography is not typically sensitive for intraductal papilloma, particularly when small. Galactography can be performed, involving cannulation and injection of contrast into a duct, which demonstrates a filling defect. Breast ultrasound and MRI can also be utilized to evaluate the extent and characteristics of the papillomas. Treatment typically requires surgical excision to exclude components of atypia or neoplasia.

Incorrect Answers: A, B, C, D, E, F, and H.

Breast abscess (Choice A) is a potential complication of mastitis, most commonly occurring in breast-feeding women. It typically presents with preceding findings of mastitis, with a localized region of developing indurated, fluctuant tissue.

Breast cancer (Choice B) encompasses many types of breast carcinoma, including invasive ductal and lobular carcinoma, medullary carcinoma, inflammatory breast carcinoma, and cystosarcoma phyllodes (Choice C). The most common type is invasive ductal carcinoma, which typically presents as a palpable, immobile breast mass that may demonstrate features such as spiculated margins and microcalcifications on mammography. They can be associated with pathologic nipple discharge, although intraductal papillomas more commonly present with unilateral bloody nipple discharge.

Galactocele (Choice D) presents as a painless breast lump typically following cessation of lactation. They do not present with pathologic nipple discharge, and they often resolve spontaneously.

Hematoma (Choice E) may occur following trauma or surgery to the breast. This would likely present as a focal area of induration or fluctuance at the site of injury.

Inflammatory carcinoma of the breast (Choice F) results from breast carcinoma invading the dermal lymphatics, resulting in diffuse cutaneous thickening and peau d'orange appearance. It is less likely to present with unilateral bloody nipple discharge.

Sebaceous cyst (Choice H), also known as an epidermal inclusion cyst, describes a cutaneous lesion that contains proliferating squamous epithelium and sebum, typically presenting as a firm, rubbery, nontender skin lump.

4. A 62-year-old woman comes to the physician for a routine health maintenance examination. She feels well. Menarche was at the age of 13 years, and menopause occurred 19 years ago. She has no family history of breast disease. Examination shows a 2 × 2-cm mass in the upper outer quadrant of the left breast. Mammography of the left breast shows calcifications in the upper outer quadrant. A biopsy of the breast mass shows invasive estrogen receptor-positive carcinoma with positive margins. Which of the following is the most appropriate next step in management?

A) Observation only
B) Cytotoxin and doxorubicin therapy
C) Tamoxifen therapy
D) Radiation therapy
E) Reexcision of the biopsy site

Correct Answer: E.

Reexcision of the biopsy site is the next most appropriate step in the setting of biopsy-proven invasive estrogen receptor-positive carcinoma. A biopsy showing positive margins indicates the presence of invasive carcinoma remaining in the patient's left breast. This requires further excision of tissue to achieve negative margins, which will provide the patient with the best possible prognosis. In addition to further excision of the site of cancer, the patient will likely require radiation therapy and adjuvant chemotherapy depending on the stage of disease.

Incorrect Answers: A, B, C, and D.

Observation only (Choice A) is not appropriate since the biopsy demonstrates positive margins indicating the presence of residual malignant cells requiring additional surgical excision.

Cytotoxin and doxorubicin therapy (Choice B) are types of chemotherapy. The patient may require chemotherapy or radiation therapy, but this should occur following excision and staging.

Tamoxifen therapy (Choice C) is a selective estrogen receptor modulator that is indicated for patients with estrogen receptor-positive breast cancer.

Radiation therapy (Choice D) may be indicated for patients who undergo a lumpectomy for breast cancer, but it would occur after an excision to achieve negative margins is attempted. Radiation therapy can also be employed at sites of metastatic disease.



5. A 42-year-old man who is HIV positive comes to the emergency department because of a 6-week history of moderate pain and intermittent bleeding from his rectum. He also has an enlarging mass in his rectum that he first noticed 6 months ago; he has not sought treatment for the pain until today. He has a 10-year history of perianal warts that were last treated 2 years ago with topical podophyllin. His medications are triple-drug antiretroviral therapy; he also takes ibuprofen for pain. Vital signs are within normal limits. There is no inguinal lymphadenopathy. Examination shows a 10-cm, cauliflower-like mass involving the entire perineum. A photograph of the mass is shown. Laboratory studies show:

Hemoglobin	14 g/dL
Leukocyte count	16,000/mm^3
Segmented neutrophils	72%
Bands	8%
Eosinophils	4%
Basophils	4%
Lymphocytes	10%
Monocytes	2%
Platelet count	215,000/mm^3
CD4+ T-lymphocyte count	300/mm^3 (Normal≥500)
Serum	
Na^+	142 mEq/L
K^+	4.3 mEq/L
Cl^-	98 mEq/L
HCO_3^-	28 mEq/L
Urea nitrogen	26 mg/dL
Creatinine	0.9 mg/dL

Which of the following is the most appropriate next step in management?

A) Topical podophyllin therapy

shown. Laboratory studies show:

Hemoglobin	14 g/dL
Leukocyte count	16,000/mm^3
Segmented neutrophils	72%
Bands	8%
Eosinophils	4%
Basophils	4%
Lymphocytes	10%
Monocytes	2%
Platelet count	215,000/mm^3
CD4+ T-lymphocyte count	300/mm^3 (Normal≥500)
Serum	
Na^+	142 mEq/L
K^+	4.3 mEq/L
Cl^-	98 mEq/L
HCO_3^-	28 mEq/L
Urea nitrogen	26 mg/dL
Creatinine	0.9 mg/dL

Which of the following is the most appropriate next step in management?

A) Topical podophyllin therapy
B) Administration of the human papillomavirus vaccine
C) Biopsy of the mass
D) Chemotherapy
E) Radiation therapy
F) Local excision of the mass

Correct Answer: C.

Biopsy is indicated when a suspicious mass exists without clear clinical explanation. Masses arising from the rectum and perineum in the setting of a known history of HIV and perianal warts may represent giant condyloma acuminatum (genital warts) or verrucous carcinoma (variant of well-differentiated squamous carcinoma). Condyloma acuminatum and verrucous carcinoma are both associated with human papillomavirus (HPV). Warts and verrucous carcinoma can appear on the penis, vagina, vulva, and/or anal canal, and patients with HIV are prone to severe condyloma lesions in these regions. To definitively diagnose the cause of this large mass, a biopsy should first take place, especially given the risk for malignancy.

Incorrect Answers: A, B, D, E, and F.

Topical podophyllin therapy (Choice A) is an antimitotic, cytotoxic medication that can be used for the treatment of genital warts once a clear diagnosis is made.

Administration of the human papillomavirus vaccine (Choice B) is recommended for both male and female patients between ages 9 and 26 years. For both genders, it provides protection against genital warts, with the additional benefit of reduced cervical cancer risk in women. This should not be the first step in management in a patient presenting with a potential giant condyloma acuminatum or verrucous carcinoma from an HPV infection.

Chemotherapy (Choice D) and radiation therapy (Choice E) are not appropriate as the next step in management requires biopsy of this undifferentiated mass, as the cause is still unknown.

Local excision of the mass (Choice F) may be considered for the definitive removal of this perineal mass but should be considered once the diagnosis is confirmed.

6. A 67-year-old man comes to the physician because of an ulcer on the glans penis that has been increasing in size over the past 6 months. He is sexually active with multiple partners and rarely uses a condom. Examination shows an uncircumcised penis with bilateral, firm inguinal adenopathy and a painless ulcer on the glans. A serologic VDRL test is nonreactive. Which of the following is the most likely diagnosis?

A) Chancroid
B) Epididymitis
C) Gonococcal urethritis
D) Herpes
E) Inguinal hernia
F) Nongonococcal urethritis
G) Penile cancer
H) Scrotal abscess
I) Syphilis

Correct Answer: G.

A majority of penile cancer is squamous cell carcinoma. While penile cancer is rare, a lack of circumcision and infection with human papillomavirus are risk factors. Precursor lesions to squamous cell carcinoma of the penis are Bowen disease, which presents as leukoplakia of the penile shaft, or erythroplasia of Queyrat, which presents as erythroplakia of the glans. The most common location of penile cancer is the glans penis. Squamous cell carcinoma can range in presentation from a small area of induration to a large ulcerating, infiltrative lesion. Differential considerations for an ulcerative penile lesion also include primary syphilis, lymphogranuloma venereum, and chancroid. As well, condyloma acuminatum, lichen planus, and psoriatic plaques may mimic early stages of penile squamous cell carcinoma.

Incorrect Answers: A, B, C, D, E, F, H, and I.

Chancroid (Choice A) presents with an exudative painful genital ulcer with inguinal lymphadenopathy. The patient presents with a painless ulcer and adenopathy, making squamous cell carcinoma or primary syphilis more likely.

Epididymitis (Choice B) is a common cause of painful scrotal swelling and refers to acute infection and inflammation of the epididymis. In younger males, this is commonly secondary to sexually transmitted infections such as *Chlamydia trachomatis* or *Neisseria gonorrhoeae*. In older males, *Escherichia coli* is more common.

Gonococcal urethritis (Choice C) typically presents with dysuria and mucopurulent penile discharge. *Neisseria gonorrhoeae* is a gram-negative diplococcus that causes cervicitis, pelvic inflammatory disease, Fitz-Hugh-Curtis syndrome, and migratory septic arthritis.

Herpes (Choice D) simplex virus 1 (HSV-1) is typically transmitted through saliva and respiratory secretions and can present with a variety of symptoms, including herpes labialis, herpetic whitlow, encephalitis, esophagitis, and keratoconjunctivitis. While commonly a pathogen located in respiratory and oral secretions, HSV-1 does have the potential for sexual contact transmission, along with herpes simplex virus 2 (HSV-2), which can lead to genital herpes. HSV-2 may also present with oral or labial lesions or encephalitis.

Inguinal hernias (Choice E) are protrusions of abdominal contents into the inguinal region through a defect in the lower abdominal wall. Incarceration and strangulation are potential complications of inguinal hernias and may require surgical correction.

Nongonococcal urethritis (Choice F) is commonly secondary to infection from *Chlamydia trachomatis* and typically presents with painful urination and watery urethral discharge. Gram stain of urine typically demonstrates a sterile pyuria, characterized by the presence of white blood cells without organisms. Diagnosis is through a urine nucleic acid amplification test. *Chlamydia trachomatis* is a common sexually transmitted disease that can cause cervicitis, pelvic inflammatory disease, epididymitis, and urethritis.

Scrotal abscesses (Choice H) can occur intrascrotal or within the skin of the scrotum. They may arise as a result of scrotal injury via external inoculation, or from severe, underlying epididymo-orchitis.

Syphilis (Choice I) demonstrates multiple stages with varying symptoms, including primary with a painless chancre; secondary with fever, lymphadenopathy, and condylomata lata; and tertiary with tabes dorsalis, aortitis, and gummas. The painless chancre of primary syphilis can present as a painless ulcerative genital lesion, although VDRL is generally positive in primary syphilis.

7. A 27-year-old woman, gravida 2, para 2, comes to the physician because of a 1-week history of painful bowel movements. She has noticed bright red blood on the surface of her stool during this period. She reports she has had bowel movements twice weekly since delivery of her youngest child 2 years ago. She has no history of serious illness and takes no medications. Examination of the perineum shows an ulcer in the posterior midline of the anal canal with an adjacent edematous skin tag at the anal verge. Rectal examination cannot be performed because of pain and increased anal sphincter tone. In addition to treatment with stool softeners, which of the following is the most appropriate next step in management?

A) Sitz bath
B) Hydrocortisone enemas
C) Anal manometry
D) Placement of elastic bands
E) Surgical drainage of the abscess

Correct Answer: A.

Sitz bath is the next most appropriate step in management for this patient presenting with an anal fissure. Anal fissures are tears in the superficial anal mucosa below the dentate line, typically along the posterior midline. Because of their location below the dentate line with resultant somatic nervous system innervation, they result in significant pain during defection and are associated with bright red blood per rectum. A common initiating factor for the development of an anal fissure is the passage of hard stool resulting in trauma to the anal mucosa. While some anal fissures self-resolve, persistent anal fissures can result in anal spasms and increased sphincter tone on examination. Initial management for persistent, symptomatic anal fissures includes administration of stool softeners, Sitz bath, topical analgesics, and topical vasodilators. The goal of this combination therapy is to relieve pain, allow for anal sphincter relaxation, and reduce traumatic passage of stool through the anal canal. Sitz bath allows for anal sphincter relaxation and improved anal mucosa blood flow to promote healing.

Incorrect Answers: B, C, D, and E.

Hydrocortisone enemas (Choice B) are typically used for treatment of ulcerative colitis and proctitis to assist in reduction of inflammation and relief of symptoms of inflammatory bowel disease.

Anal manometry (Choice C) is indicated for the evaluation of patients with chronic constipation or fecal incontinence through measuring anal sphincter pressure.

Placement of elastic bands (Choice D) is used for the ligation of internal hemorrhoids. This results in diminished blood flow to the hemorrhoid, which subsequently becomes necrotic and sloughs off.

Surgical drainage of the abscess (Choice E) is not appropriate as this patient presents with a posterior midline anal fissure, not a perianal abscess. If an anal fissure is seen in a location other than the posterior midline anus, this raises suspicion for the presence of underlying Crohn disease, which can result in complications such as anal fistulas and perianal abscesses.

8. A 65-year-old woman is brought to the emergency department 1 hour after she fell. She has right wrist pain. Her last visit to a physician was 10 years ago. Examination shows swelling and tenderness of the right wrist. An x-ray of the wrist shows no fracture, but subperiosteal bone resorption is noted in the distal phalanges. Her serum calcium concentration is 12.4 mg/dL, and serum creatinine concentration is 1.2 mg/dL. Which of the following serum concentrations is most likely to be decreased in this patient?

A) 1,25-Dihydroxycholecalciferol
B) Magnesium
C) Parathyroid hormone
D) Phosphorus
E) Vitamin C

Correct Answer: D.

Primary hyperparathyroidism presents with hypercalcemia, hypophosphatemia, bony pain, subperiosteal bone resorption, and renal involvement. Primary hyperparathyroidism is most commonly caused by a parathyroid adenoma, followed by parathyroid hyperplasia, and parathyroid carcinoma. Excessive production of parathyroid hormone (PTH) results in increased serum calcium from increased osteoclast activity, intestinal absorption, and renal tubular absorption. Serum phosphorus concentration is decreased secondary to increased excretion by the renal tubules. This patient demonstrates many clinical features of primary hyperparathyroidism; thus, phosphorus is most likely to be decreased in this patient.

Incorrect Answers: A, B, C, and E.

1,25-Dihydroxycholecalciferol (Choice A) would be increased in the setting of primary hyperparathyroidism. PTH results in stimulation of 1α-hydroxylase in the kidney, which leads to conversion of 25-hydroxycholecalciferol to 1,25-dihydroxycholecalciferol.

Magnesium (Choice B) serum concentrations rise in the setting of hyperparathyroidism. PTH promotes renal tubular absorption of magnesium; as well, hypomagnesemia upregulates PTH secretion.

Parathyroid hormone (Choice C) is excessively produced by a parathyroid adenoma, hyperplasia, or carcinoma in primary hyperparathyroidism. It is also increased in secondary and tertiary hyperparathyroidism. Causes of decreased PTH include increased calcium concentration (negative feedback) or hypoparathyroidism (idiopathic or post-surgical).

Vitamin C (Choice E) levels are not affected by PTH or calcium concentrations. It is a water-soluble vitamin and its serum concentration is dependent on dietary intake.

9. A 40-year-old woman is brought to the emergency department after a motor vehicle collision. She is unresponsive and comatose with hyperextension of all extremities. Which of the following is the most appropriate first step in management?

A) Administration of a bolus of corticosteroids
B) Intravenous administration of mannitol
C) MRI of the brain
D) Intubation with hyperventilation
E) Bilateral burr holes

Correct Answer: D.

Intubation with hyperventilation is indicated for the emergent management of elevated intracranial pressure in a comatose patient. The patient presents following trauma in an unresponsive, comatose state with hyperextension of all extremities (decerebrate posturing). Decerebrate posturing refers to the involuntary extension of the extremities and occurs in the setting of brain stem damage, typically below the level of the midbrain red nucleus. Compression of the brain stem from adjacent lesions within the skull base or cerebellum, or from intrinsic pathology within the brain stem such as pontine hemorrhagic strokes, can result in decerebrate posturing. Additionally, patients can exhibit transition from decorticate posturing (elbows, wrists, and fingers flexed) to decerebrate posturing, which typically indicates progression of transtentorial or tonsillar herniation. Patients who are comatose are considered unable to protect or maintain their airways, requiring immediate intubation to prevent aspiration or airway obstruction. Because of her decerebrate posturing, the patient should be hyperventilated, which will reduce the patient's PCO_2, leading to cerebral vasoconstriction and reduction in intracranial pressure (ICP). This reduction of ICP via hyperventilation should serve as a temporizing measure prior to definitive surgical management of presumed intracranial bleeding in the setting of traumatic brain injury.

Incorrect Answers: A, B, C, and E.

Administration of a bolus of corticosteroids (Choice A) and intravenous administration of mannitol (Choice B) also serve to reduce ICP but are not the appropriate next step in a comatose patient following acute trauma. Corticosteroids and mannitol work to reduce ICP through reduction in cerebral edema, although the effect of the medications is not immediate. This patient is unresponsive, which requires emergent intubation. As well, hyperventilation results in a faster reduction in ICP than corticosteroids or mannitol.

MRI of the brain (Choice C) is not indicated in the initial evaluation of acute traumatic brain injuries, as it would delay definitive management of a potentially life-threatening condition. CT scan of the head without contrast is indicated for the emergent evaluation of undifferentiated intracranial pathologies, especially following trauma where there may be concern for calvarial fractures, intracranial hemorrhage, and herniation.

Bilateral burr holes (Choice E) would reduce the patient's intracranial pressure and are typically used in the management of extra-axial hematomas. The patient presents in a nonspecific unresponsive state with evidence of increased ICP, which requires emergent intubation and hyperventilation as a temporizing measure prior to definitive surgical management.

10. A 52-year-old man comes to the physician for a follow-up examination. He has a 4-year history of hypertension and a 1-year history of hypokalemia. Current medications include labetalol, enalapril, and potassium chloride. His blood pressure is 154/90 mm Hg. The remainder of the examination shows no abnormalities. His fasting serum aldosterone:renin ratio is increased. A CT scan shows a 1-cm, left adrenal mass. Adrenal vein sampling before and after administration of ACTH shows bilateral hypersecretion of aldosterone. Which of the following is the most appropriate next step in management?

A) Candesartan therapy
B) Furosemide therapy
C) Spironolactone therapy
D) Bilateral adrenalectomy
E) Unilateral adrenalectomy

Correct Answer: C.

Spironolactone therapy is indicated for the management of secondary hypertension in the setting of hyperaldosteronism. The patient presents with a history of hypertension and hypokalemia, with evidence of hyperaldosteronism indicated by an elevated aldosterone:renin ratio. A CT scan demonstrates a left adrenal mass, possibly an adrenal adenoma, with bilateral hypersecretion of aldosterone on adrenal vein sampling, which may indicate bilateral adrenal hyperplasia, resulting in excess secretion of aldosterone. Spironolactone is a potassium-sparing diuretic that serves as an aldosterone receptor antagonist. This causes diminished effects of aldosterone on the renal collecting tubules, which results in decreased sodium reabsorption and potassium secretion.

Incorrect Answers: A, B, D, and E.

Candesartan therapy (Choice A) is an angiotensin II receptor blocker used primarily in the management of hypertension, heart failure, and end-stage kidney disease. It would not provide any clinical benefit in a patient with hyperaldosteronism, as renin and angiotensin II levels are appropriately suppressed because of excess aldosterone level.

Furosemide therapy (Choice B) is indicated for the management of hypervolemic states such as heart failure and cirrhosis. A known adverse effect is hypokalemia.

Bilateral adrenalectomy (Choice D) is a definitive treatment for refractory Cushing disease and is less commonly used in the setting of hyperaldosteronism. First-line management requires use of an aldosterone antagonist, as a bilateral adrenalectomy would require close monitoring and supplementation of adrenal hormones.

Unilateral adrenalectomy (Choice E) is indicated for the resection of a hyperfunctioning adrenal adenoma. In this case, adrenal vein sampling indicates bilateral hypersecretion of aldosterone, suggestive of bilateral adrenal hyperplasia, rather than a solitary hyperfunctioning adrenal adenoma.

11. A 47-year-old man comes to the physician because of a 5-week history of generalized itching and yellow skin. He underwent a total colectomy for ulcerative colitis 10 years ago. He has Gilbert syndrome, osteoarthritis, and obsessive-compulsive disorder. Current medications include fluoxetine and daily ibuprofen. He has smoked two packs of cigarettes daily for 20 years and drinks three alcoholic beverages daily. His temperature is 37°C (98.6°F), pulse is 90/min, and blood pressure is 120/70 mm Hg. Examination shows scleral icterus and jaundice. There are excoriations over the back. Abdominal examination shows no abnormalities. Laboratory studies show:

Hemoglobin	13 g/dL
Hematocrit	39%
Leukocyte count	8000/mm^3
Serum	
Bilirubin, total	12.2 mg/dL
Direct	10 mg/dL
Alkaline phosphatase	490 U/L

Endoscopic retrograde cholangiopancreatography shows narrowing of the biliary ducts. Which of the following is the strongest predisposing factor for this patient's condition?

A) Alcohol consumption
B) Cigarette smoking
C) Gilbert syndrome
D) Ibuprofen therapy
E) Ulcerative colitis

Correct Answer: E.

Ulcerative colitis is associated with the development of primary sclerosing cholangitis (PSC). PSC is a biliary tract disease that affects both the intra- and extra-hepatic bile ducts. It causes progressive inflammation and concentric fibrosis of the bile ducts, resulting in alternating regions of strictures and dilations ('beading'). These biliary strictures result in cholestasis and inadequate biliary excretion. PSC most commonly occurs in younger and middle-age men. It typically presents with progressive jaundice, hepatosplenomegaly, pruritus, light-colored stools, and dark urine. Laboratory values may demonstrate a direct hyperbilirubinemia, increased alkaline phosphatase, and a detectable peripheral anti-neutrophilic cytoplasmic antibody (pANCA). Patients with PSC are at increased risk for developing cholangiocarcinoma. Diagnostic evaluation occurs through endoscopic or magnetic retrograde cholangiopancreatography (ERCP/MRCP), which demonstrates the strictures and dilations of the intra- and extra-hepatic bile ducts; and via liver biopsy. Treatment includes dilation and stenting of strictures to improve biliary excretion, and if severe, liver transplantation may be required.

Incorrect Answers: A, B, C, and D.

Alcohol consumption (Choice A) can result in progressive hepatocellular injury and increased risk for cirrhosis, which may present with a mixed direct/indirect hyperbilirubinemia in the setting of cirrhotic clinical sequelae such as hypoalbuminemia and coagulopathy. Biliary strictures and dilations would be less likely in isolation.

Cigarette smoking (Choice B) is not a risk factor for primary sclerosing cholangitis. It is actually associated with a reduced severity of ulcerative colitis.

Gilbert syndrome (Choice C) results in a mild indirect hyperbilirubinemia secondary to mildly decreased conjugation and impaired bilirubin uptake following a stress event.

Ibuprofen therapy (Choice D), a nonsteroidal anti-inflammatory drug, is not associated with an increased risk for biliary strictures. The most common gastrointestinal adverse effect is the development of peptic ulcer disease and gastritis because of impaired prostaglandin-driven mucosal protective mechanisms.

12. A 25-year-old woman remains in the intensive care unit 5 days after undergoing pancreaticoduodenectomy for injuries sustained from a gunshot wound to the abdomen. A jejunostomy tube was placed distal to the anastomosis at the time of surgery. Current medications include morphine and cimetidine. She is 152 cm (5 ft) tall and weighs 100 kg (220 lb); BMI is 43 kg/m^2. Examination shows a well-healing incision. Which of the following is the most appropriate next step in providing nutrition to this patient?

A) Enteral tube feedings
B) Intravenous administration of 10% dextrose in water
C) Parenteral administration of lipid emulsion
D) Total parenteral nutrition
E) No nutrients should be given at this time

Correct Answer: A.

Enteral tube feedings are the most appropriate next step in providing nutrition to the patient. Enteral feeding refers to the administration of nutrition to a patient through the gastrointestinal tract. The patient recently underwent a pancreaticoduodenectomy and has a jejunostomy tube in place distal to the anastomosis. The patient is unable to receive nutrition by mouth ('per os') as the surgical anastomosis requires time to heal prior to receiving an oral food bolus. The jejunostomy tube is located distal to the surgical anastomosis and presents a route for enteral nutrition that would allow for enteral feeds and concomitant appropriate healing of the anastomosis. Enteral feeding is the preferred method for providing nutrition to patients, if possible, as it is the closest to normal, physiologic nutrition. It presents few complications and is low-cost.

Incorrect Answers: B, C, D, and E.

Intravenous administration of 10% dextrose in water (Choice B) can provide patients with supplementation to maintain glucose levels and is commonly used in the acute setting for management of hypoglycemia. It is not a suitable substitute for long-term feeding as it only provides dextrose, with no additional protein, lipid, vitamin, or mineral content.

Parenteral administration of lipid emulsion (Choice C) and total parenteral nutrition (Choice D) are forms of intravenous nutrition. These routes are used when the patient is unable to receive adequate caloric and nutrient intake through an enteral route (e.g., short gut syndrome). Parenteral nutrition typically has a specific composition of carbohydrates, proteins, lipids, electrolytes, and vitamins that are specifically tailored for the patient's nutrition requirements.

No nutrients should be given at this time (Choice E) is not the appropriate next step, as surgical healing requires appropriate nutritional provision. In absence of adequate nutrition, the patient's overall clinical condition would deteriorate because of inadequate energy substrate and anabolic supply, resulting in delayed post-surgical healing, muscle and fat wasting, and potential starvation ketosis.

13. A hospitalized 37-year-old man has moderate abdominal pain and diarrhea 3 days after undergoing gastric bypass for morbid obesity. He has passed 10 watery stools during the past 24 hours. He received antibiotic prophylaxis during the operation. His initial postoperative course was uncomplicated. Current medications include propranolol, morphine, and omeprazole. He is 178 cm (5 ft 10 in) tall and weighs 199 kg (440 lb); BMI is 63 kg/m^2. His temperature is 38.2°C (100.8°F), pulse is 92/min, respirations are 18/min, and blood pressure is 120/70 mm Hg. Abdominal examination shows moderate distention and diffuse tenderness. The surgical wounds are clean, dry, and intact. Bowel sounds are normal. An upper gastrointestinal series with a water-soluble contrast shows normal postoperative findings. Colonoscopy shows multiple areas of patchy, white mucosa. Which of the following is the most likely cause of this patient's diarrhea?

A) Blind loop syndrome
B) *Clostridium difficile* infection
C) Dumping syndrome
D) Ischemic colitis
E) Loss of vagal innervation to the ileum
F) Mesenteric vein thrombosis

Correct Answer: B.

Clostridium difficile infection is an opportunistic and often hospital-acquired infection that commonly occurs after the use of antibiotics, especially ampicillin and clindamycin, because of the loss of native colonic microbiota. This derangement in native microbiota presents an opportunity for competition-free proliferation of *C. difficile*, which produces toxins that result in dysfunction of the brush border and a subsequent secretory diarrhea. *C. difficile* infections are associated with the presence of pseudomembranes that appear as patchy regions of white mucosa on colonoscopy. The severity of *C. difficile* colitis can vary, ranging from watery diarrhea without constitutional symptoms in mild cases to toxic megacolon, colonic ischemia, and severe sepsis in fulminant cases. Treatment includes oral or rectal vancomycin, intravenous metronidazole, fidaxomicin, or colectomy depending on the severity of the patient's presentation.

Incorrect Answers: A, C, D, E, and F.

Blind loop syndrome (Choice A) can occur in cases of impaired bowel motility such as structural pouch creation during Billroth or Roux-En-Y bypass. Resultant stagnation of intestinal food bolus passage increases the risk for bacterial overgrowth. The uncontrolled growth of bacteria occurs because of the loss of peristaltic propulsion and leads to malabsorption, diarrhea, bloating, and chronic abdominal pain.

Dumping syndrome (Choice C) is a potential complication of gastric bypass resulting from the rapid emptying of contents from the stomach into the small bowel. This results in an abnormal osmotic gradient within the small bowel, which can present 15 to 30 minutes after eating a meal with severe nausea, vomiting, abdominal pain, and diarrhea.

Ischemic colitis (Choice D) refers to inadequate blood supply to the colon, which can lead to bowel wall necrosis, loss of immune barriers, and bowel perforation. This most commonly occurs in the setting of atherosclerosis, an embolic event in the setting of atrial fibrillation, or systemic hypotension.

Loss of vagal innervation to the ileum (Choice E) would result in diminished peristalsis along the region of denervation. This may occur as a post-surgical complication but would not be expected to result in severe watery diarrhea.

Mesenteric vein thrombosis (Choice F) can occur in the setting of hypercoagulability, postsurgical state, and inflammatory diseases such as pancreatitis, diverticulitis, and appendicitis. This can result in impaired venous drainage of the bowel, and potential venous bowel ischemia.

14. A previously healthy 37-year-old woman comes to the physician because of a 2-month history of intermittent, right upper abdominal pain that usually occurs after meals. She has not had fever, chills, vomiting, nausea, weight loss, or change in bowel movements. She takes no medications. Her temperature is 37°C (98.6°F), pulse is 68/min, respirations are 16/min, and blood pressure is 110/70 mm Hg. Examination shows no jaundice or scleral icterus. Abdominal examination shows no abnormalities. Her leukocyte count is 5000/mm^3. Results of liver function tests are within the reference ranges. Abdominal ultrasonography shows a thickened gallbladder wall, cholelithiasis, and a 4.2-cm hepatic mass in the right lobe. An abdominal CT scan shows the mass to be 4.2 × 3.5 cm with a central scar. Which of the following is the most appropriate next step in diagnosis?

A) Measurement of serum α-fetoprotein concentration
B) Hepatitis B virus serology
C) Radionuclide liver scan
D) MRI of the liver
E) Fine-needle aspiration biopsy of the mass
F) No further testing is indicated

Correct Answer: F.

The differential diagnosis for a liver mass with a central scar primarily includes focal nodular hyperplasia, fibrolamellar carcinoma, and cholangiocarcinoma, with less likely alternatives of hemangioma and hepatocellular carcinoma. The most likely etiology of this mass is focal nodular hyperplasia (FNH), a regenerative lesion of the liver, and the second most common benign lesion of the liver following hepatic hemangioma. It is typically asymptomatic and found incidentally in patients with right upper quadrant pain. CT scan and MRI typically demonstrate a classic central scar with radiating fibrous septa ('spoke wheel'). FNH lesions exhibit no malignant potential and do not require further testing for diagnostic workup or therapeutic intervention.

Incorrect Answers: A, B, C, D, and E.

Measurement of serum α-fetoprotein concentration (Choice A) is indicated for surveillance of patients with an increased risk for developing hepatocellular carcinoma (e.g., chronic hepatitis B infection).

Hepatitis B virus serology (Choice B) is used in the evaluation of patients with exposure to Hepatitis B to determine if they demonstrate an acute or chronic hepatitis B infection pattern, or if they exhibit appropriate immunization serology.

Radionuclide liver scan (Choice C) can be used for the evaluation of a liver mass in differentiating FNH from other primary hepatic masses. In general, hepatic masses apart from FNH will be 'cold' on a radionuclide liver scan with a region of relative photopenia (decreased tracer uptake) corresponding to the site of the mass. Because FNH contains Kupffer reticuloendothelial cells, it takes up radiotracer similar to the background liver. This patient's diagnosis of FNH can be concluded from the ultrasonography and CT scan, making a nuclear liver scan unnecessary.

MRI of the liver (Choice D) can be used to further characterize a hepatic mass when the diagnosis is uncertain. MRI offers better contrast resolution than both ultrasonography and CT scan, which allows for more definitive diagnostic evaluation in certain settings. This patient's diagnosis of FNH can be concluded from the ultrasonography and CT scan, making MRI unnecessary.

Fine-needle aspiration biopsy of the mass (Choice E) is sometimes indicated for the pathologic evaluation of focal hepatic masses. This patient's ultrasonography and CT scan accurately determine the presence of an FNH, which does not require a biopsy for further workup.

15. An 87-year-old woman is brought to the emergency department from a skilled nursing care facility because of six episodes of loose brown stools daily during the past week. There is no visible blood or mucus in the stool, and she has not had fever or abdominal pain. Five years ago, she sustained a cerebral infarction and has residual left hemiparesis. She has atrial fibrillation and multiple compression fractures from osteoporosis. Her medications include warfarin, digoxin, and famotidine. One month ago, she began taking acetaminophen with codeine for her most recent compression fracture. Her temperature is 37.1°C (98.8°F), pulse is 80/min and irregular, respirations are 16/min, and blood pressure is 130/75 mm Hg. Abdominal examination shows mild tenderness in the left lower quadrant. Bowel sounds are normal. Rectal examination shows normal tone with hard stool in the vault. Test of the stool for occult blood is negative. An abdominal x-ray shows copious stool throughout the bowel. There is no evidence of free air or obstruction. Which of the following is the most appropriate next step in management?

A) Elevation of the head of the bed during sleep
B) Elimination of milk from the diet
C) Elimination of spicy food from the diet
D) Enemas
E) Esophagogastroduodenoscopy
F) Left hemicolectomy
G) Low-fat diet
H) Mesenteric angiography
I) Omeprazole therapy
J) Recommendation to increase her milk consumption
K) Stress management
L) Total proctocolectomy
M) Ultrasonography of the abdomen
N) Upper gastrointestinal series

Correct Answer: D.

Loose brown stools in the setting of hard stool in the rectal vault and increased stool burden on an abdominal x-ray suggests overflow diarrhea in the setting of severe constipation. Chronic, severe constipation with fecal impaction in the rectum can occur in the setting of decreased mobility and opiate use, both of which suppress bowel peristalsis and increase the risk for constipation. The patient's episodes of loose brown stools are occurring since only liquid can pass adjacent to the impacted stool. The first-line treatment for severe constipation with fecal impaction is administration of an enema. This works by introducing fluid into the large bowel, which serves to expand the intestinal tract lumen, soften the impacted stool, and stimulate peristalsis. Modification of risk factors should also occur, such as increasing fiber in the diet, limiting the use of opiate medications, or introducing stool softeners or osmotic agents into the medication regimen.

Incorrect Answers: A, B, C, E, F, G, H, I, J, K, L, M, and N.

Elevation of the head of the bed during sleep (Choice A) is an intervention commonly used to reduce symptoms for gastroesophageal reflux or heart failure.

Elimination of milk from the diet (Choice B) and recommendation to increase her milk consumption (Choice J) would not be the most appropriate next step as dairy ingestion is not always associated with constipation.

Elimination of spicy food from the diet (Choice C) would not help the patient's constipation. There is no direct evidence that spicy food ingestion is associated with constipation.

Esophagogastroduodenoscopy (Choice E) allows for endoscopic evaluation of the esophagus, stomach, and duodenum, and has no role in the immediate management of constipation.

Left hemicolectomy (Choice F) is typically indicated for the management of non-metastatic left-sided colon cancer or left-sided colon cancer with metastasis that presents with significant complications such as bleeding or obstruction. Non-cancerous indications include recurrent diverticulitis, ischemic colitis, and segmental Crohn disease.

Low-fat diet (Choice G) or dietary modifications may be required, but more rapid treatment of severe constipation with fecal impaction must occur first.

Mesenteric angiography (Choice H) allows for evaluation of the mesenteric vessels such as the celiac, superior mesenteric, and inferior mesenteric arteries. Angiography is typically performed for evaluation of mesenteric ischemia or gastrointestinal bleeding.

Omeprazole therapy (Choice I) is a first-line treatment for the management of gastroesophageal reflux and peptic ulcer disease.

Stress management (Choice K) may improve bowel habits in patients with irritable bowel syndrome, which is often associated with concomitant anxiety.

Total proctocolectomy (Choice L) is indicated for the management of inflammatory bowel disease (e.g., ulcerative colitis) and for prophylactic management of familial adenomatous polyposis and Lynch syndrome.

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C) Elimination of spicy food from the diet
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Stress management (Choice K) may improve bowel habits in patients with irritable bowel syndrome, which is often associated with concomitant anxiety.

Total proctocolectomy (Choice L) is indicated for the management of inflammatory bowel disease (e.g., ulcerative colitis) and for prophylactic management of familial adenomatous polyposis and Lynch syndrome.

Ultrasonography of the abdomen (Choice M) allows for the noninvasive evaluation of abdominal visceral organs. It can be utilized for evaluation of bowel in pediatric patients, although this is limited in adults because of body habitus.

Upper gastrointestinal (GI) series (Choice N) is a fluoroscopic examination utilized for evaluation of the upper GI tract to investigate diseases such as peptic ulcer disease, gastric or duodenal neoplasms, and complications following upper GI surgery such as gastrectomy or Roux-en-Y gastric bypass.

16. A 72-year-old man is brought to the emergency department immediately after he fainted. He was eating breakfast 5 minutes before he collapsed and had the sudden onset of back pain localized to the L1 vertebral body. He has no history of back pain or any other symptoms. His temperature is 37°C (98.6°F), pulse is 140/min, respirations are 30/min, and blood pressure is 85/40 mm Hg. Breath sounds are normal. Peripheral pulses are palpated. Abdominal examination shows moderate distention and tenderness to deep palpation. Which of the following is the most likely diagnosis?

A) Acute hemorrhagic pancreatitis
B) Compression fracture
C) Ruptured abdominal aortic aneurysm
D) Thoracic aortic dissection
E) Tuberculous spinal abscess

Correct Answer: C.

Ruptured abdominal aortic aneurysm classically presents as sudden onset abdominal or back pain, with vital signs reflecting hemorrhagic shock (tachycardia, hypotension). Abdominal aortic aneurysms are more commonly seen in male smokers with a positive family history, and history of atherosclerotic disease. They commonly occur in the infrarenal abdominal aorta and may present as a palpable, pulsatile abdominal mass if large and in a thin patient. Ruptured aneurysms require emergent surgical intervention and repair.

Incorrect Answers: A, B, D, and E.

Acute hemorrhagic pancreatitis (Choice A) typically presents with symptoms of acute pancreatitis such as epigastric pain, nausea, and vomiting. Hemorrhagic pancreatitis is typically a late sequela of acute pancreatitis characterized by bleeding within the pancreatic parenchyma or directly surrounding the pancreas.

Compression fractures (Choice B) present with acute back pain at the site of the compressed vertebrae. Risk factors include osteoporosis and vertebral body metastasis. Vital signs are typically unaffected.

Thoracic aortic dissection (Choice D) classically presents with acute, sharp chest pain radiating to the back and neck. They are classified into type A or B, depending on the location and origination of the dissection flap, which dictates the necessity for surgical versus medical management.

Tuberculous spinal abscess (Choice E) is a potential complication of tuberculous vertebral discitis-osteomyelitis. It typically presents with subacute or chronic back pain with associated fever and weight loss; neurologic deficits may be present.

17. A 42-year-old construction worker is brought to the emergency department 20 minutes after falling 30 feet from a scaffold. En route to the hospital, he received 1 L of lactated Ringer solution. On arrival, he is awake and alert and has severe abdominal and leg pain. He can move all extremities. His temperature is 37°C (98.6°F), pulse is 110/min, respirations are 16/min, and blood pressure is 120/70 mm Hg. Examination shows ecchymoses over the left forehead and lower abdomen. There is an obvious deformity of the left lower extremity. There is no neck tenderness. Cardiopulmonary examination shows no abnormalities. The lower abdomen is slightly distended and exquisitely tender. There is no blood at the urethral meatus. Rectal examination shows no abnormalities. Insertion of a urinary catheter yields 30 mL of grossly bloody fluid. An additional 1.5 L of lactated Ringer solution is administered, and the left lower extremity is placed in traction. Thirty minutes later, his pulse is 95/min, and blood pressure is 140/80 mm Hg. No additional urine has drained from the catheter. Which of the following is the most likely cause of this patient's anuria?

A) Acute tubular necrosis
B) Hypovolemia
C) Rupture of the bladder
D) Syndrome of inappropriate secretion of ADH (vasopressin)
E) Transection of the urethra

Correct Answer: C.

Rupture of the bladder most commonly occurs in the setting of abdominal or pelvic trauma or from iatrogenic injury of the bladder in the setting of surgery or cystoscopy. The two most common types of bladder rupture are extraperitoneal (~80%) and intraperitoneal (~15%). Extraperitoneal ruptures typically occur in the setting of penetrating trauma and pelvic fractures, while intraperitoneal ruptures are typically associated with direct blows to already distended urinary bladders. Ruptures present with severe lower abdominal and pelvic pain and tenderness with associated anuria; blood may be noted at the urethral meatus on examination. CT scan or fluoroscopic cystography is the diagnostic examination of choice, with contrast leaking into the retro/extraperitoneal space in an extraperitoneal rupture and into the peritoneal cavity in an intraperitoneal rupture. Management depends on the type of rupture. Extraperitoneal ruptures are typically treated with an indwelling Foley catheter to minimize urinary bladder intraluminal pressure and allow healing, while intraperitoneal ruptures typically require surgical repair.

Incorrect Answers: A, B, D, and E.

Acute tubular necrosis (Choice A) typically occurs following an ischemic or nephrotoxic insult to the kidneys, which results in necrosis of the tubular epithelium. Granular, muddy brown casts are usually present on urinalysis. It is not typically associated with trauma, unless concomitant shock is present resulting in renal ischemia.

Hypovolemia (Choice B) can result in anuria if severe, although this patient has received multiple administrations of isotonic fluid and demonstrates no additional features of hypovolemia. More likely, the patient's anuria is a result of urinary bladder rupture.

Syndrome of inappropriate secretion of ADH (vasopressin) (Choice D) results from excessive ADH production, most commonly in the setting of small cell lung carcinoma or intracranial pathology, including head trauma. This leads to the development of hypotonic, euvolemic hyponatremia.

Transection of the urethra (Choice E) would result in anuria, although this would likely present with blood at the urethral meatus. Urethral injuries can occur from straddle injuries (anterior urethra) or pelvic fractures (posterior urethra). The patient has a urinary catheter in place with continued anuria, which would bypass a urethral injury.

18. An unconscious 27-year-old man is brought to the emergency department immediately after being involved in a motor vehicle collision. He was the unrestrained driver of a vehicle that struck a tree. At the scene, he was unconscious. He was not breathing spontaneously and was intubated and mechanically ventilated. On arrival, his Glasgow Coma score is 9/15. He breathes spontaneously when mechanical ventilation is discontinued. His temperature is 37°C (98.6°F), pulse is 124/min, respirations are 16/min, and palpable systolic blood pressure is 100 mm Hg. Examination shows copious bleeding from a laceration over the scalp. There is a pool of blood around his head. There is an obvious fracture of the left humerus. Breath sounds are heard bilaterally. The abdomen is soft. The pelvis is stable. In addition to intravenous administration of crystalloid solution, which of the following is the most appropriate next step in management?

A) Direct pressure to the bleeding laceration
B) CT scan of the abdomen
C) Intravenous administration of a vasopressor
D) Transfusion of type-specific packed red blood cells
E) Closed reduction of the fracture

Correct Answer: A.

Direct pressure to the bleeding laceration is the most appropriate step in immediate management of exsanguinating injuries. Lacerations to the scalp can result in hemodynamically significant blood loss because of its rich vascularity. In this specific case, airway and breathing are managed, which indicates that the immediate attention should be paid to circulation and hemodynamic stability. Tachycardia is a sign of hypovolemia, which must be attributed to hemorrhagic shock at this stage of workup. Given the patient's otherwise unremarkable physical examination outside of his left humeral fracture, direct pressure should be applied to the scalp wound, and intravascular volume loss should be replaced with 0.9% saline, followed by an emergent blood transfusion if hemodynamic instability results.

Incorrect Answers: B, C, D, and E.

CT scan of the abdomen (Choice B) is not the best next step for this patient as he presents with a benign abdomen on physical examination, borderline hemodynamic instability, and injuries primarily to the head with visible blood loss. CT scan of the abdomen may be utilized in the evaluation of blunt abdominal injury in a stable patient, whereas focused assessment with sonography for trauma (FAST) is used for hemodynamically unstable patients with a suspected abdominal source of bleeding.

Intravenous administration of a vasopressor (Choice C) is indicated for the treatment of shock unresponsive to intravenous fluids or blood in the setting of hemorrhage.

Transfusion of type-specific packed red blood cells (Choice D) is indicated for the treatment of symptomatic severe anemia or active bleeding. In the acute traumatic setting, non-type-specific packed red blood cells are used because of the rapid requirement for transfusion; however, transfusion should follow attempts at hemostasis through compression if unstable vital signs persist.

Closed reduction of the fracture (Choice E) may be required once the left humerus is examined with x-rays to assess the fracture pattern. Humerus fractures are seldom a source of internal exsanguination, in contrast to femur and pelvic fractures.

19. A 62-year-old man is brought to the emergency department because of a 12-hour history of fever, fatigue, and severe pain in the toes of his left foot. He rates the pain as a 9 on a 10-point scale. He has not had abdominal pain. Six weeks ago, he was discharged from the hospital following antibiotic treatment for diverticulitis; at that time, he was prescribed a 14-day course of intravenous piperacillin and tazobactam to be administered at home via percutaneous intravenous catheter. He has hypertension treated with atenolol. His temperature is 38.9°C (102°F), pulse is 120/min and regular, respirations are 22/min, and blood pressure is 100/60 mm Hg. There is an intravenous catheter in his medial right arm. A grade 2/6, decrescendo, diastolic murmur is heard best at the upper right sternal border. The abdomen is flat and nontender. There is no pedal edema. The second and third toes of the left foot are pale blue and tender. His leukocyte count is 17,000/mm^3 (70% segmented neutrophils, 10% bands, and 20% lymphocytes). A blood culture is positive for *Staphylococcus aureus*. Echocardiography shows vegetations on the aortic valve. Which of the following is most likely to have prevented this complication?

A) Implantation of a port instead of a catheter for administration of piperacillin and tazobactam
B) Initiation of ampicillin and gentamicin therapy instead of piperacillin and tazobactam
C) Addition of fluconazole to the medication regimen for his diverticulitis
D) Removal of the percutaneous intravenous catheter after completion of piperacillin and tazobactam therapy
E) Administration of the pneumococcal polysaccharide vaccine, 23-valent, at discharge

Correct Answer: D.

Removal of the percutaneous intravenous catheter after completion of piperacillin and tazobactam therapy would have prevented the patient's central line associated blood stream infection (CLABSI) and resultant endocarditis. The patient was treated for diverticulitis with outpatient broad-spectrum intravenous antibiotics, which required the placement of a percutaneous intravenous central catheter in his right arm. The catheter was not removed following completion of the 14-day antibiotic course. Currently, the patient presents with fever and tachycardia with a leukocytosis and blood cultures positive for *Staphylococcus aureus*. These findings raise concern for acute bacterial endocarditis, especially given the finding of pale blue and tender toes, which may be a sequela of septic emboli. Echocardiography demonstrates vegetations on the aortic valve, which confirm the diagnosis of acute bacterial endocarditis. The most likely source of bacteremia with *S. aureus* in this patient is the prolonged placement of the percutaneous intravenous catheter, which served as a nidus for infection into the bloodstream. If the catheter had been appropriately removed following completion of the 14-day antibiotic course, the patient's risk for bacteremia and endocarditis would have been minimized.

Incorrect Answers: A, B, C, and E.

Implantation of a port instead of a catheter for administration of piperacillin and tazobactam (Choice A) would not be appropriate as the placement of a port is typically reserved for patients requiring repetitive intravenous therapy such as chemotherapy for cancer care, antibiotics for cystic fibrosis, or pain management for sickle cell crises.

Initiation of ampicillin and gentamicin therapy instead of piperacillin and tazobactam (Choice B) and addition of fluconazole to the medication regimen for his diverticulitis (Choice C) would have no effect on the development of a CLABSI and acute endocarditis. The prolonged placement of the catheter after the antibiotic course finished was the main cause of the patient's subsequent bloodstream infection.

Administration of the pneumococcal polysaccharide vaccine, 23-valent, at discharge (Choice E) would not prevent the development of a CLABSI and endocarditis secondary to *S. aureus*.

20. A previously healthy 37-year-old woman is brought to the emergency department immediately after her husband found her lying in bed in a deep stupor. She has no history of a seizure disorder, and she does not take any medications. Her temperature is 37.5°C (99.5°F), pulse is 54/min, and blood pressure is 180/100 mm Hg. Examination shows a dense left hemiparesis and early decerebrate posturing. There is no evidence of trauma. Which of the following is the most likely diagnosis?

A) Arteriovenous malformation
B) Brain abscess
C) Meningioma
D) Ruptured intracerebral aneurysm
E) Thrombosed middle cerebral artery

Correct Answer: D.

A ruptured intracerebral aneurysm is the most common cause of nontraumatic subarachnoid hemorrhage (SAH). Saccular intracerebral aneurysms typically occur at bifurcations in the Circle of Willis, most commonly at the site of the anterior communicating artery. Aneurysms can also be associated with hereditary diseases such as Ehlers-Danlos syndrome and autosomal dominant polycystic kidney disease. The patient presents in a nontraumatic unresponsive state with findings concerning for increased intracranial pressure with herniation. The patient's vital signs demonstrate bradycardia with hypertension, likely reflecting the Cushing reflex. As well, the patient's dense left hemiparesis and decerebrate posturing are concerning for possible transtentorial herniation. SAH results in bleeding into the subarachnoid space. Patients may present with an acute, severe headache, stupor, or coma in severe cases. CT scan of the head demonstrates hyperdense blood products in the cerebral sulci and basal cisterns. As the blood products circulate within the subarachnoid space, complications include the development of communicating and/or obstructive hydrocephalus in the acute stage, along with rebleeding and vasospasm in the week following the initial bleed.

Incorrect Answers: A, B, C, and E.

Arteriovenous malformation (AVM) (Choice A) refers to an abnormal tangle of blood vessels resulting in communication between an artery and vein. AVMs can be located throughout the brain. They are the second most frequent cause of nontraumatic subarachnoid hemorrhage, following intracerebral aneurysm.

Brain abscess (Choice B) commonly presents with fever, headache, and a focal neurologic deficit depending on the location of the abscess. These are most commonly associated with infections from viridans streptococcus and Staphylococcus aureus. They may occur from hematogenous seeding resulting in multiple abscesses, or from direct, contiguous spread from adjacent areas of infection such as otitis media, mastoiditis, or sinusitis. *Toxoplasma gondii* abscesses are a consideration in an immunocompromised patient.

Meningioma (Choice C) is a common, benign primary brain tumor that occurs along the surfaces of the brain. They may present with focal neurologic deficits from compression of the underlying brain parenchyma or with seizures.

A thrombosed middle cerebral artery (Choice E) classically presents with contralateral motor and sensory deficits of the face and upper extremity and aphasia (e.g., Wernicke, Broca) if involving the dominant hemisphere.

21. A 37-year-old woman comes to the physician because of a 2-day history of increasing shortness of breath and fatigue. At the age of 5 years, she underwent successful repair of a ventricular septal defect. She has no other history of serious illness and takes no medications. She does not smoke cigarettes. Her pulse is 110/min and irregularly irregular, respirations are 28/min, and blood pressure is 110/60 mm Hg. Examination shows perioral cyanosis. The lungs are clear to auscultation. On cardiac examination, a grade 4/6, soft holosystolic murmur is heard best at the left sternal border. There is 3+ pretibial edema. Which of the following is the most likely explanation for this patient's symptoms?

A) Decreased pulmonary artery flow
B) Decreased pulmonary vascular resistance
C) Decreased systemic vascular resistance
D) Increased pulmonary artery blood flow
E) Increased pulmonary vascular resistance
F) Increased systemic vascular resistance

Correct Answer: E.

Increased pulmonary vascular resistance occurs in the setting of a persistent, chronic left-to-right shunt. The patient has a history of a ventricular septal defect (VSD) repair as a child, although she exhibits a holosystolic murmur heard best at the left sternal border, which suggests the continued presence of a VSD. VSD results in a left-to-right shunt, which increases pulmonary blood flow. This leads to remodeling of the pulmonary vasculature and resultant smooth muscle hypertrophy. In turn, concentric narrowing of the pulmonary arterioles occurs, which results in the development of pulmonary arterial hypertension. If severe and progressive enough, this can cause increased right ventricular pressures and associated myocardial hypertrophy, which subsequently results in reversal of the shunt, presenting with shortness of breath and cyanosis. The patient's elevated pulmonary artery and right-heart pressures increase her risk for right-sided heart failure explaining her lower extremity edema, and for atrial fibrillation explaining her irregularly irregular tachyarrhythmia.

Incorrect Answers: A, B, C, D, and F.

Decreased pulmonary artery flow (Choice A) occurs in the setting of some right-to-left shunts, for example, Tetralogy of Fallot that presents with pulmonary infundibular stenosis.

Decreased pulmonary vascular resistance (Choice B) occurs in the setting of pulmonary arteriovenous malformations.

Decreased systemic vascular resistance (Choice C) would result in decreased systemic mean arterial pressure and may be seen in cases of distributive shock such as anaphylaxis, sepsis, and neurogenic shock.

Increased pulmonary artery blood flow (Choice D) occurs in the setting of a persistent left-to-right shunt. This patient likely demonstrated chronic increased pulmonary artery blood flow from a persistent shunt, which led to pulmonary vascular remodeling. Her current presentation is secondary to the resultant increased pulmonary vascular resistance.

Increased systemic vascular resistance (Choice F) would result in increased systemic mean arterial pressure and is a common cause of chronic hypertension. This patient's presentation is secondary to increased pulmonary vascular resistance from chronic remodeling, not systemic vascular resistance.

22. A 46-year-old man comes to the emergency department 2 hours after the sudden onset of high epigastric pain. He has recently developed rheumatic pains, requiring frequent use of aspirin and ibuprofen. Examination shows an acutely ill man who is perspiring freely. His temperature is 37°C (98.6°F), pulse is 112/min, and blood pressure is 130/70 mm Hg. The lungs are clear to auscultation. The abdomen is diffusely tender with boardlike rigidity. The liver cannot be outlined by percussion. No peristalsis is audible. His leukocyte count is 14,200/mm^3 with 88% segmented neutrophils. An x-ray of the chest shows free air under the diaphragm. Which of the following is the most appropriate next step?

A) Nasogastric suction, administration of antibiotics, and admission for observation
B) Immediate x-ray of the upper gastrointestinal tract
C) Immediate administration of an H_2-receptor blocking agent
D) Immediate endoscopy of the upper gastrointestinal tract
E) Immediate surgical exploration of the upper abdomen

Correct Answer: E.

Immediate surgical exploration of the upper abdomen is indicated in cases of a perforated hollow viscus. Perforation can result from traumatic injury, erosion of an ulcer or gastritis through the muscularis and adventitia, malignant invasion, or necrosis or infarction of a segment of bowel, and presents with symptoms of peritonitis. Peritonitis classically presents as acute, severe abdominal pain which may rapidly progress to sepsis and shock. Patients typically demonstrate unstable vital signs such as fever, tachycardia, tachypnea, and hypotension. Examination discloses a guarded and rigid abdomen, which is often “board-like”. Due to translocation of intraluminal contents into the peritoneal space, fulminant sepsis can ensue. Non-steroidal anti-inflammatory medication (e.g. aspirin and ibuprofen) is a key risk factor for the development of peptic ulcer disease or gastritis, and should raise suspicion for a perforated viscus in the setting of an acutely peritonitic patient. These medications inhibit prostaglandin synthesis, which plays a critical role in the maintenance of the gastric mucosal barrier by counterbalancing the erosive effects of stomach acid through the synthesis of bicarbonate and mucus. Pneumoperitoneum on the chest x-ray shows the presence of a perforated hollow viscus. Peritonitis requires emergent exploratory laparotomy to locate and control the source and washout peritoneal contents that may promote ongoing infection.

Incorrect Answers: A, B, C, and D.

Nasogastric suction, administration of antibiotics, and admission for observation (Choice A) are not appropriate interventions for a patient presenting with findings concerning for a perforated peptic ulcer, which requires emergent surgical intervention.

Immediate x-ray of the upper gastrointestinal tract (Choice B) is unnecessary and would delay emergent surgical management of this patient’s perforated hollow viscus. As well, an erect chest x-ray is more sensitive for pneumoperitoneum than an abdominal radiograph.

Immediate administration of an H_2-receptor blocking agent (Choice C) is indicated in the medical management of peptic ulcer disease, although would not be the appropriate first step in the emergent surgical intervention for a perforated peptic ulcer.

Immediate endoscopy of the upper gastrointestinal tract (Choice D) would not be appropriate as endoscopy is not indicated in the setting of a perforated hollow viscus. Endoscopic evaluation in the setting of a presumed perforation has the potential to worsen the injury at the site of perforation and would delay definitive surgical exploration.

23. Two days after undergoing laparoscopic cholecystectomy for symptomatic cholelithiasis, an 82-year-old woman vomits and has the onset of choking followed by difficulty breathing. Her initial postoperative course was uncomplicated. She has Parkinson disease treated with carbidopa-levodopa. She has had significant bradykinesia for 2 years. She is currently receiving hydromorphone and acetaminophen therapy. She is now confused and appears slightly cyanotic. She has shortness of breath. Her temperature is 38.3°C (101°F), pulse is 108/min, respirations are 22/min, and blood pressure is 100/60 mm Hg. Pulse oximetry on room air shows an oxygen saturation of 90%. Diffuse rhonchi are heard. Which of the following is the most likely explanation for this patient's current condition?

A) Adverse effect of carbidopa-levodopa
B) Adverse effect of hydromorphone
C) Impaired cough mechanism
D) Impaired esophageal motility
E) Increased salivation

Correct Answer: C.

Aspiration pneumonia is characterized by fever, cough productive of foul-smelling sputum, malaise, and chest discomfort following an aspiration event. Patients at higher risk for aspiration include those with impaired airway-protective cough mechanisms (e.g., Parkinson disease, stroke, myasthenia gravis, depressed mental status), frequent or forceful emesis (e.g., alcohol use disorder, cyclic vomiting syndrome), or abnormal pharyngeal or airway anatomy (e.g., malignancy, trachea-esophageal fistula). These patients are more likely to aspirate gastric contents into the lung, which results in bacterial seeding with gastrointestinal or oral flora and can lead to pneumonia. Frequently, aspiration occurs in a dependent segment of the lung such as bilateral lower lobes when erect or the lingula, right middle lobe, and superior segments of the lower lobes while lying down.

Incorrect Answers: A, B, D, and E.

Adverse effects of carbidopa-levodopa (Choice A), which is first-line therapy for patients with Parkinson disease, include arrhythmias because of increased formation of systemic catecholamines and if used over a long period of time, dyskinesia and an ‘on-off’ phenomenon.

Adverse effects of hydromorphone (Choice B) include gastrointestinal disturbances such as nausea, vomiting, and constipation; significant respiratory depression; altered mental status; and miosis in the setting of overdose. This can result in aspiration of contents because of a depressed mental status and failure of airway protection. However, this patient does not show signs of significant impairment from hydromorphone, making impaired airway protective reflexes in the setting of known Parkinson disease more likely.

Impaired esophageal motility (Choice D) is a potential cause of aspiration because of impaired transit of food bolus along the length of the esophagus, which can result in regurgitation and increased risk for aspiration. This patient demonstrates vomiting in the postoperative period with a history of Parkinson disease, which likely explains her aspiration event, not esophageal dysmotility.

Increased salivation (Choice E) is a potential adverse effect of acetylcholinesterase inhibitors used in myasthenia gravis or Alzheimer disease. It is not a typical adverse effect of carbidopa-levodopa or additional medications the patient is currently taking.

24. A 32-year-old man comes to the physician for evaluation of infertility. Two months ago, he was found to have a low sperm count during an infertility workup. There is no family history of infertility. Examination shows no abnormalities except for dilated veins in the left scrotum. Which of the following is the most likely mechanism of this patient's infertility?

A) Decreased serum testosterone concentration
B) Idiopathic
C) Increased scrotal temperature
D) Increased serum corticosteroid concentration
E) Isolated luteinizing hormone deficiency

Correct Answer: C.

A varicocele refers to dilated veins of the pampiniform plexus resulting from elevated venous pressure. Varicoceles are commonly located on the left side because of increased resistance to venous flow as the left gonadal vein drains into the left renal vein. The dilated veins result in increased temperature of the scrotum and testicle, which increases risk for infertility secondary to impaired spermatogenesis. Treatment for varicoceles may require surgical embolization or ligation to improve the patient's infertility.

Incorrect Answers: A, B, D, and E.

Decreased serum testosterone concentration (Choice A) is a cause of infertility seen in diseases such as Klinefelter syndrome and Kallmann syndrome. These are typically associated with hypogonadism and other clinical findings such as eunuchoid body shape and gynecomastia in Klinefelter syndrome, and anosmia in Kallmann syndrome.

Idiopathic infertility (Choice B) is not the correct answer as the patient demonstrates a left-sided varicocele, which is a known cause of infertility related to increased scrotal and testicular temperature.

Increased serum corticosteroid concentration (Choice D) is characteristic of Cushing syndrome, which commonly presents with features of hypertension, moon facies, abdominal striae, osteoporosis, hyperglycemia, and amenorrhea. It can result in infertility in women, which is related to amenorrhea. While it can result in impotence and decreased libido in men, it is not directly associated with male infertility.

Isolated luteinizing hormone deficiency (Choice E) is an uncommon cause of infertility in men. Insufficient production of luteinizing hormone would result in inadequate stimulation of Leydig cells in the testes to produce testosterone. This could result in infertility, although this patient has a varicocele on physical examination, which is a more common cause of infertility.

The response options for the next **2** items are the same. Select one answer for each item in the set.

For each patient with a limp, select the most likely diagnosis.

A) Legg-Calvé-Perthes disease
B) Osgood-Schlatter disease
C) Osteomyelitis
D) Recurrent sprain
E) Septic arthritis
F) Slipped capital femoral epiphysis
G) Stress fracture
H) Tibia vara
I) Toxic synovitis

25. A previously healthy 14-year-old boy is brought to the physician because of a 2-week history of severe pain in his right knee and hip and an associated limp. He has had intermittent, mild pain in the same knee and hip for 3 months. He plays on his junior high school football team. He is at the 50th percentile for height and greater than the 95th percentile for weight. His temperature is 37°C (98.6°F). Abduction of the right hip is slightly decreased compared with the left. There is mild tenderness of the right hip. Examination of the left hip shows no abnormalities. He walks with a limp and is unable to bear his full weight on the right.
Correct Answer: F.

Slipped capital femoral epiphysis (SCFE) most commonly occurs in overweight children between ages 10 and 15 years. It results in displacement of the femoral epiphysis relative to the femoral neck secondary to anterosuperior movement of the metaphysis because of a Salter-Harris type 1 fracture of the growth plate. SCFE typically presents with a painful limp and if severe, may result in restricted range of motion of the hip joint (e.g., limited abduction and internal rotation of the hip) and inability to bear weight on the affected lower extremity. Diagnosis requires evaluation of both hips in frontal and frog-leg views for comparison. If untreated, complications include avascular necrosis of the femoral head, limited range of motion and gait impairment, and premature osteoarthritis. To prevent these complications, treatment requires surgical fixation of the femoral epiphysis.

Incorrect Answers: A, B, C, D, E, G, H, and I.

Legg-Calvé-Perthes disease (Choice A) refers to idiopathic avascular necrosis of the femoral head that most commonly occurs in younger children from age 4 to 9 years. It may present with a limp and is variably painful.

Osgood-Schlatter disease (Choice B) refers to osteochondrosis or traction apophysitis of the tibial tubercle that typically occurs in adolescent, athletic children. This presents with pain along the anterior aspect of the proximal tibia and knee that is exacerbated by kneeling. Physical examination typically demonstrates tenderness over an enlarged tibial tubercle.

Osteomyelitis (Choice C) is an infection of bone and bone marrow and typically presents acutely, subacutely, or chronically from direct inoculation or hematogenous spread. Patients typically report pain, difficulty bearing weight, and overlying erythema. Imaging typically demonstrates localized osseous erosive changes.

Recurrent sprain (Choice D) refers to stretching or varying degrees of tearing of a ligament. One of the more common sites of sprain is the ankle joint, particularly from inversion injuries resulting in sprains of the anterior talofibular and calcaneofibular ligaments. This patient does not present following an injury, and sprains of hip joint ligaments (e.g., ischiofemoral, iliofemoral, pubofemoral) are less common.

Septic arthritis (Choice E) results from bacterial infection of the synovial joint space, most commonly by *Staphylococcus aureus*. The affected joint demonstrates pain, swelling, and erythema. Arthrocentesis is indicated for the evaluation of monoarticular erythema and swelling to evaluate for septic arthritis, which characteristically shows purulent synovial fluid with greater than 50,000 leukocytes per mm^3.

Stress fracture (Choice G) refers to an overuse injury where bone is subjected to repetitive stress, resulting in linear microfractures in trabecular bone. This is commonly seen in patients such as long-distance runners and military recruits. Patients may present with slowly progressive pain at the site of the stress fracture (e.g., tibia, metatarsals), initially worse with application of stress but then possibly progressing to pain with daily activities if not treated appropriately. X-rays may demonstrate a component of periosteal/endosteal thickening, although they are often insensitive.

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Incorrect Answers: A, B, C, D, E, G, H, and I.

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Stress fracture (Choice G) refers to an overuse injury where bone is subjected to repetitive stress, resulting in linear microfractures in trabecular bone. This is commonly seen in patients such as long-distance runners and military recruits. Patients may present with slowly progressive pain at the site of the stress fracture (e.g., tibia, metatarsals), initially worse with application of stress but then possibly progressing to pain with daily activities if not treated appropriately. X-rays may demonstrate a component of periosteal/endosteal thickening, although they are often insensitive.

Tibia vara (Choice H) refers to Blount disease, which is characterized by progressive pathologic bowing (genu varum) of the tibia. There is both an infantile and adolescent form. X-rays typically demonstrate asymmetric tibial bowing with metaphyseal beaking.

Toxic synovitis (Choice I) refers to transient inflammation of the synovium, usually from an unknown cause, that results in acute joint pain. This most commonly occurs in pediatric patients younger than age 10 years. It typically results in inability to bear weight with some restriction to range of motion and is often preceded by an upper respiratory infection.

For each patient with a limp, select the most likely diagnosis.

A) Legg-Calvé-Perthes disease
B) Osgood-Schlatter disease
C) Osteomyelitis
D) Recurrent sprain
E) Septic arthritis
F) Slipped capital femoral epiphysis
G) Stress fracture
H) Tibia vara
I) Toxic synovitis

26. A 3-year-old girl is brought to the physician because of a 2-day history of a limp. Two weeks ago, she had fever and upper respiratory symptoms that resolved spontaneously. She has no history of serious illness and takes no medications. Her temperature is 37°C (98.6°F). Examination of the left hip shows moderate pain to palpation. Her leukocyte count is 11,000/mm^3 (60% segmented neutrophils, 2% eosinophils, 30% lymphocytes, and 8% monocytes), and erythrocyte sedimentation rate is 12 mm/h.
Correct Answer: I.

Toxic synovitis (Choice I) refers to transient inflammation of the synovium, usually from an unknown cause, that results in acute joint pain. This most commonly occurs in pediatric patients younger than age 10 years and is often preceded by an upper respiratory infection or viral prodrome. It typically results in an inability to bear weight with some restriction to range of motion. The most common joint affected is the hip. Erythrocyte sedimentation rate (ESR) is typically within the reference range, which assists in differentiating this from septic arthritis. It is critical to differentiate this condition from septic arthritis, as toxic synovitis only requires anti-inflammatory medications for treatment whereas antibiotics and operative washout are indicated for septic arthritis.

Incorrect Answers: A, B, C, D, E, F, G, and H.

Legg-Calvé-Perthes disease (Choice A) refers to idiopathic avascular necrosis of the femoral head that most commonly occurs in younger children from age 4 to 9 years. It may present with a limp and is variably painful.

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Tibia vara (Choice H) refers to Blount disease which is characterized by progressive pathologic bowing (genu varum) of the tibia. There is both an infantile and adolescent form. X-rays typically demonstrate asymmetric tibial bowing with metaphyseal beaking.

27. An obese 72-year-old man is brought to the emergency department 15 minutes after he collapsed at home. His wife reports that he has had upper abdominal pain, nausea, and vomiting for the past 24 hours. He has hypertension and coronary artery disease. He is diaphoretic. His temperature is 36.5°C (97.7°F), pulse is 115/min and irregularly irregular, respirations are 22/min, and palpable systolic blood pressure is 80 mm Hg. There is no jugular venous distention. The lungs are clear to auscultation. No murmurs or gallops are heard. The abdomen is tender and rigid. Pulmonary artery catheterization shows:

Cardiac index	1.2 L/min/m^2 (N=2.5–4.2)
Mean pulmonary arterial pressure	5 mm Hg (N=9–16)
Pulmonary capillary wedge pressure	1 mm Hg (N=5–16)
Systemic vascular resistance	1929 dyn·s/cm^5 (N=770–1500)

Which of the following is the predominant type of shock in this patient?

A) Anaphylactic
B) Cardiogenic
C) Hypovolemic
D) Neurogenic
E) Septic

Correct Answer: C.

Hypovolemic shock is the predominant type of shock in this patient who presents with upper abdominal pain, nausea, and vomiting. Pulmonary artery catheterization indicates a decreased cardiac index, mean pulmonary arterial pressure, and pulmonary capillary wedge pressure, with an increased systemic vascular resistance (SVR). Hypovolemic shock occurs secondary to significant reductions in a patient's intravascular volume most commonly related to hemorrhage, dehydration, or gastrointestinal losses, which results in decreased stroke volume and cardiac output. This, in turn, results in arteriolar vasoconstriction to increase SVR in an attempt to maintain mean arterial pressure. If progressive and severe enough, the body is unable to further compensate, which leads to the development of hypotension and inadequate organ perfusion (shock).

Incorrect Answers: A, B, D, and E.

Anaphylactic (Choice A) and septic (Choice E) shock are forms of distributive shock, which are characterized by a primary reduction in SVR. This reduction in SVR is secondary to IgE-mediated histamine and cytokine release in anaphylactic shock, and tumor necrosis factor and cytokine-mediated endothelial dysfunction in septic shock. Cardiac output increases to compensate for low SVR in the early stages of distributive shock. If the inciting state is not appropriately treated, further decompensation can occur, resulting in progressive hypotension and insufficient perfusion with associated end-organ damage. Pulmonary artery catheterization would demonstrate an increased cardiac index and decreased SVR in cases of distributive shock.

Cardiogenic (Choice B) shock can occur in the setting of acute myocardial infarction, severe valvular dysfunction, severe heart failure, or arrhythmia. Pulmonary artery catheterization typically demonstrates decreased cardiac index with an elevated pulmonary capillary wedge pressure if there is left-sided heart dysfunction, and an increased SVR.

Neurogenic (Choice D) shock occurs in the setting of a catastrophic central nervous system injury resulting in diminished sympathetic output to the heart and vasculature. This results in hypotension secondary to decreased myocardial contractility and arteriolar vasodilation, with associated bradycardia. Pulmonary artery catheterization would demonstrate decreased cardiac index with decreased SVR.

28. Four days after admission to the hospital for treatment of metastatic breast cancer with chemotherapy, a 42-year-old woman has increased pain of the extremities and ribs. She has a history of hypertension and renal insufficiency. She underwent bilateral mastectomy 4 years ago. She is currently taking acetaminophen with codeine (two tablets four times daily) and amitriptyline (50 mg at bedtime) with no relief of pain. She sleeps well but awakens early because of pain. Her appetite is good. Her pulse is 100/min and regular, respirations are 20/min, and blood pressure is 100/80 mm Hg. The pupils are round and reactive. There is tenderness to palpation of the chest wall and vertebrae. She is alert and oriented but winces in pain when she moves. She says that she does not feel depressed but occasionally wishes that she would not wake up. She is hopeful that she will get better. Her mood is reserved, but she smiles when she discusses her children. Laboratory studies are pending. Which of the following is the most appropriate next step in management?

A) Carbamazepine therapy
B) Clonazepam therapy
C) Oxycodone therapy
D) Paroxetine therapy
E) Valproic acid therapy
F) Regional nerve blockade

Correct Answer: C.

Oxycodone therapy is the most appropriate medical therapy to assist in relief of metastatic cancer-related pain. The patient has a history of metastatic breast cancer, likely with numerous osseous metastases based on her report of multifocal musculoskeletal pain and tenderness to palpation on physical examination. To provide the patient with sufficient comfort for her osseous metastatic pain, opioid medications are the first-line analgesic medication. While the use of opioid medications should be limited and alternative therapies instituted in the management of chronic pain when reasonable because of the risk for addiction, opioids are the most effective at providing relief in cancer-related pain. Care should be taken to prescribe the appropriate dose that yields sufficient relief.

Incorrect Answers: A, B, D, E, and F.

Carbamazepine therapy (Choice A) is an anti-epileptic drug that works through blocking sodium channels. It is first-line therapy for the treatment of focal partial seizures and trigeminal neuralgia. It can be used in the treatment of neuropathic pain, although this patient's pain is likely related to underlying osseous metastatic disease.

Clonazepam therapy (Choice B) is used as an anxiolytic in the management of anxiety and panic attacks.

Paroxetine therapy (Choice D) is a selective serotonin reuptake inhibitor (SSRI) that has broad application in psychiatry, including in the treatment of depression and generalized anxiety disorder. The patient states that she does not feel depressed, and specifically states she is hopeful she will get better.

Valproic acid therapy (Choice E) can be used in the treatment of epilepsy, migraines, and bipolar disorder. It is not indicated for cancer-related pain.

Regional nerve blockade (Choice F) can be utilized as periprocedural anesthesia or in the acute treatment of localized pain. The patient has diffuse pain, which would not be well treated with regional nerve blockade.

29. A 67-year-old man is brought to the physician because of severe pain in the right foot for 6 hours. On examination, the right foot is pale and cool, and pedal pulses are not palpable. He can wiggle his toes. Examination of the left foot shows no abnormalities. There are bilateral femoral pulses and pulsatile masses in the popliteal fossae. Which of the following is the most appropriate next step in diagnosis?

A) Cardiolipin antibody assay
B) Measurement of transcutaneous oxygen tension in the feet
C) Measurement of serum antithrombin III concentration
D) Impedance plethysmography
E) Arteriography with runoff
F) Venography of the right lower extremity

Correct Answer: E.

Arteriography with runoff is the most appropriate next step in diagnosis to further investigate the patient's symptoms consistent with acute peripheral arterial lower extremity occlusion. The patient presents with acute onset severe right foot pain associated with a pulseless, cool, and pale right foot. These findings are suspicious for acute lower extremity arterial thromboembolic occlusion. The typical symptoms for acute arterial extremity occlusion include severe pain, pallor, poikilothermia, paresthesias, and pulselessness. Definitive evaluation of the location of arterial occlusion is through CT arteriography with runoff, which will better delineate the extent and location of occlusion, allowing for pre-procedural thrombectomy planning.

Incorrect Answers: A, B, C, D, and F.

Cardiolipin antibody assay (Choice A) and measurement of serum antithrombin III concentration (Choice C) are indicated in the workup for hereditary and acquired hypercoagulability. Cardiolipin antibodies are present in antiphospholipid syndrome, which is an autoimmune disorder that can be primary or secondary to an additional autoimmune disorder (e.g., systemic lupus erythematosus), and presents with recurrent miscarriages and arterial or venous thromboembolic disease. Antithrombin III deficiency is another cause of hypercoagulability that can be hereditary or acquired as a result of nephrotic syndrome. It results in diminished effectiveness of heparin.

Measurement of transcutaneous oxygen tension in the feet (Choice B) would allow for further investigation of asymmetric decreased perfusion to the right foot, although this would delay therapeutic intervention for the patient's acute arterial occlusion of the right lower extremity, which can be diagnosed based on symptoms and findings on CT arteriography.

Impedance plethysmography (Choice D) is a noninvasive test that allows for measurement of changes in electrical resistance in regions of the body, which indirectly reflects blood volume alterations. It can be used for evaluation of arterial or venous thrombotic occlusion, although in this case, the diagnosis of peripheral arterial occlusion can be made based on symptoms. Plethysmography would delay arteriography and thrombectomy.

Venography of the right lower extremity (Choice F) can be performed either through CT scan or fluoroscopy. It allows for the assessment of acute and chronic venous disease and has no role in the localization of an arterial occlusion.

30. Three days after undergoing an appendectomy for a perforated appendix, a 42-year-old man develops dyspnea. Arterial blood gas analysis on room air shows:

pH	7.34
Pco_2	35 mm Hg
Po_2	85 mm Hg
HCO_3^-	22 mEq/L

Ventilation-perfusion lung scans show a large perfusion defect in the left lower lobe with adequate ventilation. Which of the following is the most appropriate next step in management?

A) Administration of heparin
B) Administration of warfarin
C) Pulmonary angiography
D) Placement of a vena cava filter
E) Pulmonary embolectomy

Correct Answer: A.

Administration of heparin is the most appropriate next step in the management of a patient with a pulmonary embolism. Patients are at increased risk for venous thromboembolic disease in the early postoperative period secondary to venous stasis from decreased mobility and hypercoagulability from systemic inflammation. This patient's arterial blood gas demonstrates hypoxia secondary to a V/Q mismatch from a perfusion defect shown on the ventilation-perfusion scan. The risk for hemodynamic compromise from a large pulmonary embolus outweighs the risk for bleeding at 3 days post-operation. The patient should be treated with heparin which will allow for immediate anticoagulation, along with rapid reversal if bleeding complications arise.

Incorrect Answers: B, C, D, and E.

Administration of warfarin (Choice B) is indicated for chronic anticoagulation of venous thromboembolism but would not be appropriate as isolated therapy without heparin bridging.

Pulmonary angiography (Choice C) constitutes invasive catheter angiographic evaluation of the pulmonary arteries. This is no longer necessary for the diagnosis of pulmonary embolism given advances in ventilation-perfusion scans and CT pulmonary angiography, but may still be performed during pulmonary embolectomy (Choice E). Embolectomy is sometimes required in the setting of a massive pulmonary embolism resulting in obstructive shock and systemic hypotension, or in setting of severe right heart strain, which may require more rapid removal of the embolus.

Placement of a vena cava filter (Choice D) is indicated for the prevention of further pulmonary emboli from deep venous thrombosis in the lower extremities when a patient has a contraindication to therapeutic anticoagulation. Common contraindications to therapeutic anticoagulation include bleeding diatheses, active hemorrhage, immediate postoperative state, or a history of hemorrhagic stroke.

31. A 37-year-old woman comes to the physician because of a 3-month history of neck swelling and tightness in her throat. She has not had weakness, weight change, or heat or cold intolerance. Examination shows a diffusely enlarged and firm thyroid gland; there is no nodularity. Serum thyroid-stimulating hormone, thyroxine (T_4), and triiodothyronine (T_3) concentrations are within normal limits. Serum studies show circulating antibodies against thyroid peroxidase and thyroglobulin. Which of the following is the most likely diagnosis?

A) Anaplastic thyroid carcinoma
B) Chronic lymphocytic thyroiditis (Hashimoto disease)
C) Graves disease
D) Papillary carcinoma of the thyroid gland
E) Subacute thyroiditis

Correct Answer: B.

Chronic lymphocytic thyroiditis (Hashimoto disease) is the most common form of thyroiditis and is characterized by the presence of antithyroid peroxidase and antithyroglobulin antibodies. The early stages of Hashimoto thyroiditis can present with neck swelling and a diffusely enlarged, nontender thyroid gland. The patient's clinical symptoms and thyroid laboratory studies may demonstrate no significant abnormalities or can show evidence of hyperthyroidism from destruction of thyroid follicular cells and the unregulated release of thyroid hormone. During the chronic stages of Hashimoto thyroiditis, the patient typically develops primary hypothyroidism from the underlying inflammatory destruction of normal thyroid parenchyma and resultant insufficient production of thyroid hormone.

Incorrect Answers: A, C, D, and E.

Anaplastic thyroid carcinoma (Choice A) is a type of thyroid cancer that typically occurs in older patients. It exhibits a very poor prognosis and has the ability to invade local structures such as the esophagus and trachea, producing symptoms such as dysphagia and hoarseness.

Graves disease (Choice C) is the most common cause of hyperthyroidism and occurs because of the presence of TSH-receptor-stimulating antibodies. This results in a diffusely enlarged thyroid gland on physical examination, along with pretibial myxedema and exophthalmos. Thyroid laboratory studies typically demonstrate findings of a primary hyperthyroidism with increased thyroxine and triiodothyronine, and decreased thyroid-stimulating hormone.

Papillary carcinoma of the thyroid gland (Choice D) is the most common thyroid cancer. It typically presents with a solitary thyroid nodule and is characterized by the presence of nuclear grooves with empty-appearing nuclei and psammoma bodies on histological evaluation. It typically carries a good prognosis.

Subacute thyroiditis (Choice E), also known as granulomatous de Quervain thyroiditis, is a self-limited thyroiditis that typically presents with tender thyroid gland enlargement often associated with flu-like symptoms.

32. A 12-year-old girl is brought to the emergency department 30 minutes after falling off a second-floor balcony. On arrival, her pulse is 105/min, respirations are 22/min, and blood pressure is 105/77 mm Hg. The chest is clear to auscultation. The abdomen is soft and nontender. An x-ray of the chest shows no abnormalities. Which of the following is the most appropriate next step in diagnosis?

A) X-ray of the cervical spine
B) X-rays of the abdomen and pelvis
C) Cystography
D) Ultrasonography
E) CT scan of the abdomen
F) CT scan of the chest
G) Peritoneal lavage
H) Arteriography

Correct Answer: A.

X-ray of the cervical spine is indicated for further evaluation of a potential cervical spine injury. X-rays of the cervical spine provide information about cervical spine alignment, fractures, and retropharyngeal soft tissue injuries. The patient fell from a second-floor balcony, which raises her risk for a cervical spine injury. If there are any concerning findings for a cervical spine injury on the x-ray, subsequent confirmation with a CT scan or MRI of the cervical spine should occur. As well, the necessity of cervical spine imaging is guided by the NEXUS criteria, which suggest cross-sectional imaging is necessary if any of the following features are present: focal neurologic deficit, midline spinal tenderness, altered level of consciousness, intoxication, or distracting injury.

Incorrect Answers: B, C, D, E, F, G, and H.

X-rays of the abdomen and pelvis (Choice B), CT scan of the abdomen (Choice E), and CT scan of the chest (Choice F) are not indicated as the patient demonstrates no abnormal examination findings in these regions. As well, the chest x-ray demonstrates no abnormalities. The patient fell from a second-floor balcony (generally 3 to -3.6 meters (10 to 12 feet)), which only minimally raises her risk for an acute traumatic injury in her abdomen or pelvis in the absence of associated symptoms.

Cystography (Choice C) is indicated for evaluation of the urinary bladder when a bladder injury is suspected. This allows for characterization of an intraperitoneal versus extraperitoneal bladder rupture, which dictates the next step in management.

Ultrasonography (Choice D) utilizes sound waves for evaluation of organs. Ultrasonography does not appropriately evaluate osseous structures because of the high density and acoustic impedance of cortical bone.

Peritoneal lavage (Choice G) is used for the evaluation of hemoperitoneum in abdominal injury. While it has mostly been replaced by evaluation with ultrasonography or CT scan, it may be useful in situations with equivocal results or low-resource settings.

Arteriography (Choice H) is the gold standard for evaluation of arterial anatomy and pathology. For example, if the patient presented with an acute abdominal bleed in the setting of trauma, arteriography would be a useful means for diagnostic evaluation and therapeutic intervention, although CT angiography has primarily taken over the role of diagnosis in the post-traumatic setting.

33. A 57-year-old woman is admitted to the hospital for an elective gastrectomy. During insertion of a subclavian venous catheter via a left infraclavicular approach, the patient suddenly begins squirming under the drapes and has shortness of breath. Her pulse is 100/min, respirations are 24/min, and blood pressure is 100/70 mm Hg. Examination shows jugular venous distention. Breath sounds are decreased on the left. Which of the following is the most likely diagnosis?

A) Air embolism
B) Cardiac tamponade
C) Claustrophobia
D) Massive hemothorax
E) Tension pneumothorax

Correct Answer: E.

Pneumothorax occurs as air accumulates within the pleural space because of injury of the bronchopulmonary parenchyma or penetrating trauma violating the pleura, both of which may occur during placement of a subclavian venous catheter. If accumulation progresses, mediastinal structures may be stretched or compressed, compromising venous return and resulting in obstructive shock (known as a tension pneumothorax). On physical examination, a pneumothorax presents as unilateral diminished breath sounds with hyperresonance to percussion. Obstruction of venous return results in jugular venous distention, and shifting of mediastinal structures results in contralateral tracheal deviation. The diagnosis of tension pneumothorax should be made clinically. Treatment requires emergent needle decompression of the pneumothorax, followed by tube thoracostomy.

Incorrect Answers: A, B, C, and D.

Air embolism (Choice A) can occur in both venous and arterial circulations. Risk factors include thoracic trauma, barotrauma, decompression sickness, cardiothoracic surgery, and surgery of the head and neck. Symptoms vary based on the location of embolism. Typical symptoms of a large venous air embolism include acute shortness of breath, tachypnea, and chest pain.

Cardiac tamponade (Choice B) occurs from rapid-onset and/or large volume pericardial effusions resulting in compression of the cardiac chambers and obstructive shock. Physical examination findings include Beck triad (hypotension, distended jugular veins, and distant heart sounds). ECG may demonstrate electrical alternans and there may be pulsus paradoxus on evaluation of blood pressure. Treatment requires emergent pericardiocentesis.

Claustrophobia (Choice C) is a type of specific phobia associated with crowded or tight spaces. It would not present with unilateral loss of breath sounds following subclavian catheter placement, which is indicative of a pneumothorax.

Massive hemothorax (Choice D) can occur following thoracic trauma or as a complication of thoracostomy placement. Physical examination typically demonstrates reduced breath sounds on the side of injury along with dullness to percussion. Hemorrhagic shock can result from substantial blood losses into the hemithorax. Hypovolemia in this setting manifests as a flat jugular vein, rather than jugular venous distention.

34. A 67-year-old woman has required mechanical ventilation to maintain adequate tissue oxygenation since she sustained a severe head injury 2 weeks ago. Serial x-rays of the chest during hospitalization show findings consistent with acute respiratory distress syndrome. Cultures of bronchial washings have grown numerous organisms for which she is receiving broad-spectrum antibiotic therapy. A current x-ray of the chest shows a cavitary lesion in the right upper lobe of the lung. Which of the following is the most likely diagnosis?

A) Aspergillosis
B) Atelectasis
C) Lung abscess
D) Pneumatocele
E) Tuberculosis

Correct Answer: C.

A lung abscess presents with symptoms of pulmonary infection such as cough, hemoptysis, fever, tachypnea, and hypoxia with a cavitary lesion often containing an air-fluid level present on imaging. It is a potential complication of pneumonia, especially in the setting of acute respiratory distress syndrome (ARDS), mechanical ventilation, or immunosuppression. ARDS is characterized by respiratory failure with bilateral diffuse interstitial and airspace opacities from underlying diffuse alveolar damage and noncardiogenic pulmonary edema. ARDS is associated with aspiration, pneumonia, trauma, sepsis, and shock. Mechanical ventilation is often required in the management of ARDS because of hypoxia and hypoventilation. Further, polymicrobial flora on bronchial washings raises concern for ventilator-associated pneumonia (VAP). The most common organisms in the setting of VAP are gram-negative rods (e.g., *Klebsiella* species, *Pseudomonas* species), anaerobes, and *Staphylococcus aureus*. Given the virulence of the possible underlying infectious organisms, the development of a new cavitary lesion is likely secondary to the formation of a lung abscess. Treatment requires further administration of broad-spectrum antibiotics, prevention of aspiration, and source control with surgical resection or percutaneous drainage.

Incorrect Answers: A, B, D, and E.

Aspergillosis (Choice A) can result in many different clinical presentations such as aspergillomas, allergic bronchopulmonary aspergillosis, chronic necrotizing aspergillosis, and airway invasive or angioinvasive aspergillosis. Aspergillomas are the most common; they are fungal masses that arise within existing cavitary lesions of the lung, such as those caused by previous infection with tuberculosis, emphysematous blebs or bullae, or from cavitary squamous cell lung carcinoma.

Atelectasis (Choice B) refers to the partial or complete collapse or incomplete expansion of pulmonary parenchyma. There are multiple types of atelectasis, including obstructive, passive, compressive, cicatricial, and adhesive. It is most common in patients who are immobile and/or in the post-surgical state, who are unable to produce adequate tidal volume to expand the lungs. Atelectasis would not present with a cavitary lesion.

Pneumatoceles (Choice D) are air-filled cystic spaces in the pulmonary parenchyma that usually occur following pneumonia (post-infectious pneumatocele), trauma, or secondary to barotrauma in neonates.

Tuberculosis (Choice E) most commonly occurs in homeless persons, people with alcohol use disorder, incarcerated patients, those from endemic areas (e.g., Africa, South America), and those living in close contact with infected individuals. Tuberculosis classically presents with fever, night sweats, weight loss, and hemoptysis. The chest x-ray in reactivation tuberculosis shows cavitary lesions in bilateral lung apices, with possible evidence of a Ghon complex (pulmonary calcified granulomas and hilar adenopathy) from the prior primary tuberculous infection.

35. Three weeks after undergoing arteriography through the right groin for evaluation of progressive left calf claudication, a 64-year-old man is noted to have a palpable thrill and a continuous machinery murmur at the arteriography site. Examination shows decreased pedal pulses on the right; pulses had been normal prior to the procedure. The arteriogram is shown. Which of the following factors is most predictive of the development of heart failure in this patient?



A) Degree of edema in the lower extremity
B) Groin compression causing bradycardia
C) Presence of pallor with elevation and dependent rubor
D) Presence of a pseudoaneurysm
E) Size of the abnormality

Correct Answer: E.

The patient presents with a palpable thrill, diminished pulses, and a continuous machine-like murmur at the site of prior arteriography in the right groin. The arteriogram demonstrates dense contrast located in the right external iliac and femoral arteries, with contrast inappropriately seen in the adjacent right femoral vein and distal external iliac vein. The patient's clinical presentation and findings on arteriography indicate the formation of an arteriovenous fistula (AVF), likely a complication of the previous arteriography. This AVF results in abnormal communication between an artery and vein, leading to low-resistance, high-volume flow of blood between the artery and vein. An AVF reduces systemic vascular resistance through the creation of a shunt to the high capacitance, low pressure venous system and can lead to the development of high-output cardiac failure. The size of the AVF is most predictive of the risk for developing heart failure, as a larger AVF results in higher flow between the artery and vein, requiring the heart to compensate with greater output to supply the remainder of the systemic circulation.

Incorrect Answers: A, B, C, and D.

Degree of edema in the lower extremity (Choice A) would be an indicator of heart failure in a patient with systolic or diastolic heart failure not secondary to an arteriovenous fistula. Lower extremity edema is an indicator of right-sided heart failure, and the degree of edema may indicate the severity of dysfunction.

Groin compression causing bradycardia (Choice B) can occur as a vasovagal reaction in response to the compression of the groin. This is not related to the arteriovenous fistula and risk for heart failure.

Presence of pallor with elevation and dependent rubor (Choice C) are consistent with peripheral arterial disease. In the setting of chronic claudication, severe peripheral arterial disease may be indicated by the presence of pallor with elevation and dependent rubor.

Presence of a pseudoaneurysm (Choice D) may present with a pulsatile mass at the site of prior arteriography or trauma. On arteriography, pseudoaneurysms typically present as contrast-filled outpouchings near the site of prior arteriotomy. They do not confer risk for the development of heart failure.

36. A 10-year-old girl has had fatigue and pallor for 3 weeks. Six weeks ago, she underwent aortic valve replacement with a mechanical prosthesis. She is receiving digoxin therapy. Her temperature is 37°C (98.6°F), pulse is 115/min, respirations are 24/min, and blood pressure is 100/60 mm Hg. A grade 2/6, systolic ejection murmur is heard along the left sternal border, and a grade 2/6, decrescendo diastolic murmur is heard along the left sternal border to the cardiac apex. The liver and spleen are palpable. Her hemoglobin concentration is 4.6 g/dL. A blood smear shows schistocytes. Which of the following is the most appropriate next step in management?

A) Discontinuation of digoxin therapy
B) Transfusion of packed red blood cells
C) Transfusion of whole blood
D) Furosemide therapy
E) Intravenous methylprednisolone therapy

Correct Answer: B.

Transfusion of packed red blood cells is indicated in patients with acute, severe, symptomatic anemia with a hemoglobin concentration less than 7 g/dL. The patient presents after undergoing aortic valve replacement with a mechanical valve prosthesis. She demonstrates severe anemia with a hemoglobin concentration of 4.6 g/dL and schistocytes on blood smear, indicating hemolytic anemia. The differential for a hemolytic anemia with schistocytes includes macroangiopathic anemias secondary to severe aortic stenosis, hemolysis secondary to a mechanical valve, and microangiopathic hemolytic anemias such as disseminated intravascular coagulation, hemolytic uremic syndrome, and thrombotic thrombocytopenia purpura. This patient's hemolytic anemia is likely secondary to hemolysis of red blood cells as they cross a malfunctioning mechanical aortic valve. Given her severe, symptomatic anemia, the most appropriate initial step in management is administration of packed red blood cells to improve her hemoglobin concentration and decrease the risk for end-organ damage from severe anemia.

Incorrect Answers: A, C, D, and E.

Discontinuation of digoxin therapy (Choice A) would be indicated if she presented with signs of digoxin toxicity, such as heart block, diarrhea, nausea, vomiting, and blurry yellow vision. Digoxin is used for symptomatic relief in systolic heart failure as it improves cardiac myocyte contractility through inhibition of the sodium-potassium ATPase.

Transfusion of whole blood (Choice C) is indicated for acute blood loss, hemorrhagic shock, and during exchange transfusion. This patient would benefit from packed red blood cells instead, as her anemia is secondary to macroangiopathic hemolysis of red blood cells from her mechanical aortic valve.

Furosemide therapy (Choice D) is mainly utilized for management of volume status, such as in heart failure and cirrhosis. There is no indication that the patient is hypervolemic, and her symptoms are related to severe anemia.

Intravenous methylprednisolone therapy (Choice E) is used to reduce inflammation in rheumatologic (e.g., systemic lupus erythematosus), neurologic (e.g., multiple sclerosis), and infectious diseases (e.g., meningitis, hepatitis), as an adjunct in allergic and anaphylactic reactions, and in management of bronchospasm and reactive airway disease (e.g., asthma, emphysema). This patient presents with severe, symptomatic anemia, for which intravenous corticosteroids would provide no benefit.

37. A previously healthy 47-year-old man is admitted to the hospital because of a 3-day history of constant increasingly severe abdominal pain. A diagnosis of diverticulitis is made, and bowel rest and antibiotic treatment are recommended. The patient insists that he undergo an operation to relieve the pain. A second opinion is obtained from an independent physician who states that an operation is contraindicated, because it carries an unacceptable level of risk and will not improve the patient's condition. After prolonged discussion with the patient and his wife, the patient continues to insist that he undergo an operation. Which of the following is the most appropriate course of action?

A) Ask the patient's wife to formally refuse the operation on the patient's behalf
B) Obtain a court order to refuse the operation
C) Obtain permission from the hospital ethics committee not to perform the operation
D) Proceed with the operation
E) Refuse to proceed with the operation

Correct Answer: E.

Refuse to proceed with the operation is the most appropriate course of action when a procedure is not medically indicated and would carry an unacceptable level of risk with no benefit to the patient's condition. The core ethical principles of medicine are autonomy, beneficence, nonmaleficence, and justice. While patient autonomy typically supersedes the other core ethical principles, a physician must always make treatment decisions based on what is best for the patient and with the goal to 'do no harm.' The patient is presenting with diverticulitis and is placed on appropriate medical management with bowel rest and antibiotic treatment. An operative procedure that would not improve the patient's condition but would expose the patient to increased risk for harm is not ethically appropriate. The appropriate course of action is to refuse the operation as the core ethical principles of nonmaleficence and beneficence outweigh autonomy in this scenario

Incorrect Answers: A, B, C, and D.

Ask the patient's wife to formally refuse the operation on the patient's behalf (Choice A) would bypass the patient's right to express his wishes. The wife would only make decisions for her husband as a surrogate if the patient lost decision-making capacity. The patient still demonstrates decision-making capacity, under which he expresses his desire for an operation. It is the responsibility of the treating physician to balance the patient's autonomy with the risks and benefits of an operation, which in this case should lead the physician to deny the operation.

Obtain a court order to refuse the operation (Choice B) and obtain permission from the hospital ethics committee not to perform the operation (Choice C) are not appropriate courses of action, as it has already been determined that the operation is contraindicated and would place the patient at too much risk. It is the duty of the treating physician to abide by the core ethical principles and to balance the patient's wishes with the indications and potential harm of an operation. A court and hospital ethics committee serve to provide guidance in controversial and dubious medical decisions, not in clear cases.

Proceed with the operation (Choice D) would align with the patient's wishes but would place the patient at an unacceptable risk for harm without any benefit. This decision would contradict the physician's duty to uphold the principles of beneficence and nonmaleficence.

38. A 60-year-old man with alcoholism has had diarrhea and generalized weakness for 5 days. Abdominal examination shows an enlarged liver and mild diffuse tenderness with shifting dullness. His serum calcium concentration is 6 mg/dL, and serum amylase activity is within normal limits. Which of the following is the most likely cause of the hypocalcemia?

A) Acute pancreatitis
B) Acute renal failure
C) Hypokalemia
D) Hypomagnesemia
E) Type IV hyperlipoproteinemia

Correct Answer: D.

Hypomagnesemia commonly occurs in the setting of alcohol use disorder, malnutrition, malabsorption, and diarrhea, and should be anticipated in the case of a patient presenting with signs of chronic, severe alcohol use disorder such as hepatomegaly and ascites. Common causes of hypocalcemia include vitamin D deficiency, hypomagnesemia, acute pancreatitis, citrate chelation from blood product administration, end-stage kidney disease, and post-surgical or idiopathic hypoparathyroidism. Given the patient's alcohol use disorder, hypomagnesemia is the most likely cause of the patient's hypocalcemia. Treatment requires repletion of both magnesium and calcium.

Incorrect Answers: A, B, C, and E.

Acute pancreatitis (Choice A) can result in the development of hypocalcemia secondary to saponification of peripancreatic fat, which in turn binds ionized calcium. This patient demonstrates a normal serum amylase, which would be increased in the setting of acute pancreatitis.

Acute renal failure (Choice B) does not result in hypocalcemia as intestinal absorption and parathyroid hormone levels are not acutely affected. Chronic renal failure can result in hypocalcemia and secondary hyperparathyroidism.

Hypokalemia (Choice C) typically presents with muscle weakness, cramps, abdominal ileus, paresthesias, and hyporeflexia. It is commonly caused by diarrhea, vomiting, loop or thiazide diuretic use, insulin use, or hypomagnesemia. Hypokalemia does not contribute to the development of hypocalcemia.

Type IV hyperlipoproteinemia (Choice E) is an autosomal dominant disease that presents with hypertriglyceridemia contained within very-low density lipoproteins. Increased triglycerides are a risk factor for acute pancreatitis, which can result in hypocalcemia, although this patient does not demonstrate findings of acute pancreatitis.

39. A 27-year-old man comes to the emergency department 6 hours after being bitten during a fistfight. He has a 3 × 2-cm flap laceration on the dorsum of the right hand that extends into the subcutaneous fat. The surrounding tissues are contused. No tendons are exposed. The avulsed skin is cyanotic and insensate on a 1-cm margin. There is no bleeding. Which of the following is the most appropriate management?

A) Debridement and application of a sterile dressing to the open wound
B) Debridement and primary closure of the wound by mobilization of adjacent skin
C) Debridement and flap rotation to achieve tension-free primary closure of the wound
D) Debridement and split-thickness skin grafting to the soft-tissue defect

Correct Answer: A.

Debridement and application of a sterile dressing to the open wound is indicated in the management of a human bite wound that extends into the subcutaneous tissue. The management of a human bite wound includes extensive cleaning with an antiseptic solution and debridement of the wound, followed by the application of a sterile dressing to the open wound to maintain cleanliness of the wound site. Because of the increased risk for infection from a human bite, especially from *Eikenella corrodens*, the wound is often left open as this reduces the risk for the development of infection. As well, any puncture wound that already demonstrates infection or is older than 6 to 12 hours should generally not be closed. Prophylactic antibiotics should be administered, specifically amoxicillin-clavulanate or ampicillin-sulbactam as these provide coverage for *E. corrodens*.

Incorrect Answers: B, C, and D.

Debridement and primary closure of the wound by mobilization of adjacent skin (Choice B), flap rotation to achieve tension-free primary closure of the wound (Choice C), and split-thickness skin grafting to the soft-tissue defect (Choice D) are all options for the closure of a soft tissue wound. The use of these various techniques depends on the size and location of the wound. The patient presents with a human bite wound 6 hours after it occurred. Given its increased risk for infection, the wound should not be closed unless necessary to reduce high-risk complications involving neurovascular or bony structures. It should be left open after debridement covered by a sterile dressing, which will reduce the risk for developing a wound site infection.

40. A 38-year-old man has vomited small amounts of bright red blood on several occasions over the past 9 months. He has a duodenal ulcer and has had four episodes of abdominal pain and indigestion over the past 3 years, with the most recent episode occurring 5 months ago. Over the past year, he has had severe, persistent diarrhea, with four to six stools daily. Current examination shows a temperature of 37.3°C (99.1°F) and marked abdominal tenderness. The most appropriate next step is measurement of which of the following serum concentrations?

A) Amylase
B) α_1-Antitrypsin
C) Carcinoembryonic antigen
D) Cortisol
E) Gastrin

Correct Answer: E.

Gastrin is physiologically produced by G cells in the gastric antrum and functions to stimulate parietal cells within the gastric body to produce hydrochloric acid. Zollinger-Ellison syndrome, the constellation of findings associated with gastrinoma, stems from a gastrin-secreting tumor located typically within the pancreas or duodenum. It results in excessive production of acid by the gastric parietal cells. This can lead to recurrent, chronic duodenal or jejunal ulcers, which can present with abdominal pain, diarrhea secondary to malabsorption, and possible hematemesis, melena, or hematochezia. The initial step in evaluation of a gastrinoma is to measure the serum gastrin concentration. If abnormal, a secretin stimulation test should be performed, which would demonstrate elevated gastrin concentrations after administration of secretin, opposite of the normal, physiologic inhibition. Cross-sectional imaging should then be performed to determine the location of the gastrinoma for planning of surgical resection.

Incorrect Answers: A, B, C, and D

Amylase (Choice A) is an enzyme that assists in the digestion of carbohydrates and is primarily secreted in saliva and from the exocrine pancreas. Increased amylase activity may indicate an underlying pathology of either the salivary glands (e.g., parotitis) or pancreas (e.g., pancreatitis).

α_1-Antitrypsin (Choice B) deficiency results in the early development of panacinar emphysema and cirrhosis. It is a hereditary disease resulting from misfolding of α_1-antitrypsin, which aggregates in hepatocytes. This results in hepatocyte injury and progression to cirrhosis at a young age. The lack of functional α_1-antitrypsin release also results in an imbalance of proteases and anti-proteases in the lung parenchyma, resulting in the destruction of alveolar septa and development of panacinar emphysema.

Carcinoembryonic antigen (Choice C) is a nonspecific, often-increased tumor marker associated with colorectal and pancreatic cancers.

Cortisol (Choice D) is typically measured in the evaluation of Cushing syndrome or Addison disease. Cushing syndrome commonly presents with hypertension, moon facies, abdominal striae, osteoporosis, hyperglycemia, and amenorrhea. Addison disease presents as primary adrenal insufficiency with generalized malaise, fatigue, myalgias, weight loss, weakness, hypoglycemia, and occasionally hypotension, with associated skin and mucosal hyperpigmentation.

41. A 12-year-old boy has had weakness, pallor, and black, shiny stools for 5 days. He has had no abdominal pain or other symptoms. Laboratory studies show:

Hematocrit	26%
Mean corpuscular volume	70 μm^3
Mean corpuscular hemoglobin concentration	22% Hb/cell

An abdominal scintigram, using technetium 99m pertechnetate, shows uptake in the right lower quadrant separate from the activity in the stomach, kidneys, and bladder. Which of the following is the most likely diagnosis?

A) Henoch-Schönlein purpura
B) Ileocecal intussusception
C) Juvenile colonic polyp
D) Meckel diverticulum
E) Ulcerative colitis

Correct Answer: D.

Meckel diverticulum is one of the most common causes of painless, bloody stools in children. A Meckel diverticulum results from persistence of the vitelline duct and can demonstrate ectopic, functional gastric or pancreatic tissue. It can present with acute or chronic hematochezia or melena, often painless, which can lead to the development of iron deficiency anemia. It typically presents in childhood, most commonly before age 2 years, although because of its indolent nature, it may not be diagnosed until later in life. It is commonly located 61 cm (2 ft) proximal to the ileocecal valve and is 5 cm (2 in) in length. Because of its location, it serves as a potential lead-point for intussusception. A technetium 99 m pertechnetate scan demonstrates uptake in the right lower quadrant, corresponding with ectopic gastric mucosa within the Meckel diverticulum.

Incorrect Answers: A, B, C, and E.

Henoch-Schönlein purpura (Choice A) is a small-vessel vasculitis that occurs in children and typically presents with gravity-dependent purpura (e.g., buttocks, legs, and feet), arthralgias, hematuria, and abdominal pain (e.g., intussusception).

Ileocecal intussusception (Choice B) occurs from telescoping of the terminal ileum into the cecum. This can result in intermittent abdominal pain from compromised blood supply to the intussuscepted bowel. This typically occurs in children. It can present with 'currant jelly' stools if there is associated bowel infarction. Painless melena would not be expected.

Juvenile colonic polyps (Choice C) can be associated with a variety of polyposis syndromes such as Peutz-Jeghers syndrome and juvenile polyposis syndrome. These syndromes feature primarily hamartomatous polyps throughout the gastrointestinal tract and are associated with an increased risk for colorectal carcinoma. Meckel diverticulum is a much more common cause of painless melena in a child.

Ulcerative colitis (Choice E) is a type of inflammatory bowel disease that results in mucosal and submucosal ulceration and inflammation that progresses retrograde along the colon from the rectum. This typically presents with chronic bloody diarrhea, tenesmus, and abdominal pain. While inflammatory bowel disease can occur in children, it would not typically present with painless melena.

42. A 19-year-old man is brought to the emergency department 15 minutes after his motorcycle collided head-on with a truck. No loss of consciousness at the scene is reported. On arrival, he is agitated but oriented to person, place, and time. He responds to verbal commands. Supplemental oxygen and intravenous fluids are administered. His pulse is 115/min, respirations are 18/min, and blood pressure is 110/70 mm Hg. There are multiple abrasions over the forehead, chest, abdomen, and right lower extremity. The pupils are equal and reactive to light. The trachea is midline, and breath sounds are equal bilaterally. Heart sounds are normal. The abdomen is mildly distended, soft, and diffusely tender. His hemoglobin concentration is 11.8 g/dL, and leukocyte count is 14,000/mm^3. Urinary catheterization yields clear urine. X-rays of the cervical spine and pelvis show no abnormalities. An x-ray of the chest shows a moderate amount of free intra-abdominal air under the diaphragm. Which of the following is the most appropriate next step in management?

A) Lateral decubitus x-ray
B) CT scan of the abdomen
C) Upper gastrointestinal endoscopy
D) Diagnostic peritoneal lavage
E) Laparotomy

Correct Answer: E.

Laparotomy of the abdomen is indicated for the emergent investigation and management of a perforated hollow viscus. Abdominal pain, distention, tenderness to palpation, anemia, leukocytosis, and x-ray evidence of pneumoperitoneum following trauma is consistent with a perforated viscus and early peritonitis. Peritonitis requires emergent surgical laparotomy to identify and repair any perforation, lavage the peritoneum and prevent sepsis, exsanguination, and bowel necrosis.

Incorrect Answers: A, B, C, and D.

Lateral decubitus x-ray (Choice A) of the abdomen can be utilized to better delineate the presence of pneumoperitoneum if there are indeterminate findings on prior x-rays. The patient should be positioned with the left side against the table, which will allow for visualization of free intra-abdominal air along the surface of the liver.

CT scan of the abdomen (Choice B) and upper gastrointestinal endoscopy (Choice C) are not indicated in the emergent management of an acute abdomen. The patient presents following trauma with pneumoperitoneum, a life-threatening condition that requires emergent laparotomy for definitive evaluation and management.

Diagnostic peritoneal lavage (Choice D) is used for the evaluation of hemoperitoneum in traumatic abdominal injury. While it has mostly been replaced by evaluation with ultrasound or CT scan, it may be useful in situations with equivocal results or low-resource settings.

43. A previously healthy 52-year-old woman comes to the emergency department because of a 2-day history of abdominal cramps and vomiting. She has not passed stool or flatus during this period. She has no history of similar symptoms. She underwent an abdominal hysterectomy 10 years ago. Her temperature is 37.7°C (99.8°F), pulse is 110/min, and blood pressure is 140/70 mm Hg. The lungs are clear to auscultation and percussion. Abdominal examination shows distention and mild tenderness but no peritoneal signs; bowel sounds are active and in rushes. Laboratory studies show:

Hematocrit	42%
Leukocyte count	11,500/mm^3
Serum	
Na^+	140 mEq/L
Cl^-	101 mEq/L
K^+	3.6 mEq/L
HCO_3^-	28 mEq/L
Urea nitrogen	40 mg/dL
Glucose	110 mg/dL
Creatinine	1.7 mg/dL

Which of the following is the most likely diagnosis?

A) Acute cholecystitis
B) Colon cancer
C) Complete small-bowel obstruction
D) Ileus secondary to renal failure
E) Perforated viscus

Correct Answer: C.

Complete small-bowel obstruction (SBO) is the most likely diagnosis in a patient with previous abdominal surgery presenting with a history of abdominal pain, vomiting, and obstipation. Obstruction of the small bowel occurs from partial or complete blockage of the small bowel lumen and typically presents with nausea, vomiting, and abdominal pain. Partial SBO allows a degree of continued flatus with diminished stooling, and complete SBO will result in obstipation (no passage of stool or flatus). SBO has many potential etiologies, although the most common are post-surgical peritoneal adhesions and hernias. On physical examination, SBO typically presents with abdominal tenderness, distention, tympany to percussion, and borborygmi (high-pitched, hyperactive bowel sounds). Potential complications of SBO include bowel rupture and/or necrosis, which can result in sudden-onset peritonitic abdominal signs such as rebound tenderness and guarding. Abdominal x-rays typically demonstrate multiple air-fluid levels in the setting of dilated small bowel loops. Management requires bowel rest and intravenous hydration followed by surgical intervention if the obstruction does not autoreduce. Partial SBO may resolve with monitoring, supportive care, and bowel rest, whereas complete obstruction or any complicated partial obstruction generally requires management through exploratory laparotomy.

Incorrect Answers: A, B, D, and E.

Acute cholecystitis (Choice A) presents with fever, abdominal pain, and tenderness to palpation in the right upper quadrant, often in a patient with a history of gallstones. It would be unlikely to result in small bowel obstruction unless it was complicated by the formation of a cholecystoduodenal fistula leading to gallstone ileus.

Colon cancer (Choice B) most commonly occurs in the rectosigmoid region of the large bowel. Lesions within the ascending colon, by convention, typically result in an exophytic mass and slow bleeding resulting in iron deficiency anemia. Cancers within the descending and rectosigmoid colon are more likely to be infiltrative, resulting in partial obstruction of the large bowel. Colon cancer is unlikely to result in complete obstruction.

Ileus secondary to renal failure (Choice D) is less likely for this patient given her normal urea nitrogen, sodium, and potassium concentrations. Ileus refers to intestinal hypomotility without a mechanical obstruction, most commonly occurring following surgery or in the setting of electrolyte abnormalities (e.g., end-stage kidney disease resulting in hyperkalemia), and typically presents with diffuse small and large bowel dilatation.

A perforated viscus (Choice E) typically presents with acute-onset diffuse abdominal pain, with findings of abdominal rigidity, rebound tenderness, and guarding on physical examination (‘peritoneal signs’). X-rays may demonstrate evidence of pneumoperitoneum, preferably obtained in an erect or left lateral decubitus position. Emergent surgical laparotomy is required for diagnosis and management of the underlying etiology.

44. A 25-year-old construction worker has had fever and a painful, swollen right hand for 2 days. His temperature is 39°C (102.2°F). The dorsum of the hand is swollen, erythematous, and tender; there is a small traumatic laceration on the dorsum of the hand with a beefy-red expanding margin and red streaks extending up the arm. The axillary lymph nodes are palpable and tender. Which of the following is the most likely pathogen?

A) *Bacteroides fragilis*
B) *Clostridium difficile*
C) *Clostridium perfringens*
D) *Clostridium tetani*
E) *Enterobacter cloacae*
F) *Enterococcus faecalis*
G) *Escherichia coli*
H) *Staphylococcus epidermidis*
I) *Streptococcus pneumoniae*
J) *Streptococcus pyogenes* (group A)

Correct Answer: J.

Streptococcus pyogenes (Group A) and Staphylococcus aureus are the most common causes of bacterial lymphadenitis. Cutaneous erythema and swelling at a site of inoculation, with streaking along lymphatic drainage territories and associated tender lymphadenopathy is characteristic of lymphadenitis. Bartonella henselae is another bacterial cause of lymphadenitis related to cat scratches ('Cat scratch disease'), although given the patient's injury secondary to a construction-related laceration, *Streptococcus pyogenes* lymphadenitis is more likely.

Incorrect Answers: A, B, C, D, E, F, G, H, and I.

Bacteroides fragilis (Choice A) is a normal component of the gastrointestinal microbiota. It only results in infections when displaced from the colon such as following surgery or trauma where it has the potential to cause bacteremia, intra-abdominal infections, peritonitis, and subcutaneous abscesses.

Clostridium difficile (Choice B) is an opportunistic infection that most commonly occurs following antibiotic alterations of the colonic microbiome. It can present with watery or bloody diarrhea depending on the severity of the infection.

Clostridium perfringens (Choice C) can result in myonecrosis (gas gangrene) following traumatic injury. Its spores can also survive in undercooked food, and if ingested, can result in food poisoning.

Clostridium tetani (Choice D) is the bacterial cause of tetanus, resulting in the development of spastic paralysis following inoculation via a penetrating traumatic wound.

Enterobacter cloacae (Choice E) is a gram-negative rod that can result in a variety of diseases such as urinary tract infection, pneumonia, skin and soft-tissue infections, endocarditis, septic arthritis, osteomyelitis, ophthalmic infections, and bacteremia. It is not a common cause of lymphadenitis.

Enterococcus faecalis (Choice F) is found in normal colonic flora but may result in urinary or biliary tract infections, or subacute endocarditis following gastrointestinal or genitourinary invasive procedures.

Escherichia coli (Choice G) is a gram-negative rod with multiple strains presenting with different clinical symptoms. These range from the watery diarrhea of enterotoxigenic *E. coli* to bloody diarrhea and dysentery in enteroinvasive and enterohemorrhagic *E. coli*. Additionally, *E. coli* is a common cause of urinary tract infections such as cystitis and pyelonephritis.

Staphylococcus epidermidis (Choice H) is a normal flora of the skin and nose. It can be associated with intravascular catheter and joint prosthesis infections.

Streptococcus pneumoniae (Choice I) is a gram-positive diplococcus associated with otitis media, pneumonia, sinusitis, and meningitis. It does not typically cause lymphadenitis.

45. A 63-year-old man has had dysphagia and chest pain during meals for 4 months. He has a 6-year history of gastroesophageal reflux. He has limited his intake to liquids for 3 weeks because he regurgitates solid food. Which of the following is the most likely cause of his symptoms?

A) Disordered neuromuscular transmission in the esophagus
B) Disordered neuromuscular transmission in the oropharynx
C) Failure of oropharyngeal propulsion
D) Paraesophageal hiatal hernia
E) Stricture of the distal esophagus

Correct Answer: E.

A stricture of the distal esophagus is the most likely cause of the patient's symptoms. The patient presents with chronic solid-food dysphagia and chest pain following multiple years of gastroesophageal reflux disease (GERD). Chronic GERD, especially if under-managed, raises the risk for development of a distal esophageal stricture. The chronic exposure of the distal esophagus to reflux of gastric acid results in recurrent inflammation leading to potential fibrosis and strictures. Esophageal strictures characteristically present with solid-food dysphagia and regurgitation since the decreased esophageal luminal diameter impedes the passage of solid foods worse than liquid foods. Chronic GERD increases the patient's risk for development of Barrett esophagus (intestinal metaplasia) and esophageal adenocarcinoma, which should be considered in the patient's management and diagnostic evaluation.

Incorrect Answers: A, B, C, and D.

Disordered neuromuscular transmission in the esophagus (Choice A) refers to achalasia, which is a type of esophageal dysmotility disorder resulting from deficient peristalsis along the length of the esophagus and impaired relaxation of the lower esophageal sphincter. It manifests as dysphagia to both solids and liquids, odynophagia, weight loss, halitosis, and regurgitation of undigested food. It is diagnosed through a barium swallow plus esophageal manometry.

Disordered neuromuscular transmission in the oropharynx (Choice B) and failure of oropharyngeal propulsion (Choice C) typically occur from impaired cranial nerve function. Oropharyngeal motility is dictated by the coordinated movement of several muscles (e.g., palate, tongue, pharynx), which are primarily innervated by the facial nerve, glossopharyngeal nerve, vagus nerve, and hypoglossal nerve. Underlying neurologic dysfunction (e.g., stroke) can result in incoordination of the oropharyngeal muscles, which can present as transfer dysphagia related to difficulty propelling the food bolus from the oropharynx to the hypopharynx and esophagus.

Paraesophageal hiatal hernia (Choice D) results from protrusion of the gastric fundus through the esophageal diaphragmatic hiatus. The gastroesophageal junction remains in its normal location. This can result in obstructive symptoms as the herniated gastric fundus exerts mass effect on the adjacent distal esophagus. The patient demonstrates risk factors for a reflux-associated distal esophageal stricture, which is more common.

46. A 57-year-old man comes to the physician because of persistent increasingly severe left-sided chest pain for 1 month. He works as an industrial engineer. Examination shows absent breath sounds and dullness to percussion over the lower portion of the left hemithorax. An x-ray of the chest shows a left-sided pleural effusion with an extensive peripheral soft-tissue density. Thoracentesis shows a bloody, exudative effusion; cultures are negative. Cytology of pleural fluid shows malignant cells of uncertain type. An open biopsy specimen shows a dimorphic picture; there are areas of spindle cells with numerous mitotic figures and areas of cuboidal epithelial cells. Exposure to which of the following agents is the most likely cause of his condition?

A) Asbestos
B) Nickel
C) Talc
D) Tobacco
E) Toluene diisocyanate

Correct Answer: A.

Asbestos exposure commonly occurs in the setting of roofing, plumbing, and shipbuilding. It increases the risk for pulmonary asbestosis, characterized by the development of pleural calcified plaques and potential lower-lobe-predominant interstitial fibrotic changes. It also increases the risk for the development of bronchogenic carcinoma and mesothelioma. The patient presents with a left-sided pleural effusion with extensive peripheral soft-tissue density and cytology of the pleural fluid demonstrating malignant cells. Biopsy shows spindle cells with numerous mitotic figures. This presentation and associated x-ray and pathologic findings are typical for pleural mesothelioma. Mesothelioma often presents with pleural soft-tissue thickening and an exudative, often hemorrhagic, pleural effusion. Asbestos exposure is the main risk factor for mesothelioma, while smoking tobacco is not an associated risk factor.

Incorrect Answers: B, C, D, and E.

Nickel (Choice B) exposure is a common cause of contact dermatitis, which is a T-lymphocyte mediated type IV hypersensitivity reaction that results in an erythematous, pruritic rash in the location of exposure.

Talc (Choice C) can result in pulmonary talcosis, a pneumoconiosis, from inhalation of talc powder. This can cause the development of bilateral ground glass opacities and progressive fibrosis if severe. Additionally, pulmonary talc granulomatosis can occur in intravenous drug users who inject tablets intended for oral use. This results in talc embolization to the pulmonary circulation, which induces foreign body granuloma formation and diffuse pulmonary nodule formation.

Tobacco (Choice D) is not a risk factor for mesothelioma. It is the most common risk factor for bronchogenic carcinoma (e.g., small cell and non-small cell lung carcinoma).

Toluene diisocyanate (Choice E) vapor is a mucosal irritant that can result in bronchospasm and asthma-like symptoms such as cough, shortness of breath, and wheezing. It is not a risk factor for the development of mesothelioma.

47. A 62-year-old man with hypertension and type 2 diabetes mellitus comes to the physician for a routine ophthalmologic examination. He reports no visual problems. A cholesterol embolus is seen in a branch of the left retinal artery. Which of the following is the most likely cause?

A) Carotid plaque
B) Diabetic retinopathy
C) Hypertensive retinal artery changes
D) Idiopathic retinal artery thrombosis
E) Mural thrombus in the left ventricle

Correct Answer: A.

Carotid plaque is the most common risk factor for the development of a cholesterol embolus to the retinal artery. Risk factors for macrovascular disease such as carotid atherosclerosis include diabetes mellitus, hyperlipidemia, and hypertension. Atherosclerosis results from accumulation of lipids in the tunica intima and is marked on histology by the presence of foam cells. Depending on the stability of the resulting atheromatous plaque, there is a risk for plaque rupture and release of cholesterol emboli. Thrombus formation resulting from a ruptured carotid plaque raises risk for embolic disease to the brain and eyes, especially the retinal artery. This can potentially result in permanent (central retinal artery occlusion) or transient (amaurosis fugax) painless monocular vision loss, both of which are warning signs of an impending or current thromboembolic cerebrovascular accident.

Incorrect Answers: B, C, D, and E.

Diabetic retinopathy (Choice B) is a microvascular complication of chronic hyperglycemia. It can present with nonproliferative pathology such as retinal hemorrhages and macular edema or proliferative pathology such as neovascularization with resultant retinal traction.

Hypertensive retinal artery changes (Choice C) consist of vascular smooth muscle hypertrophy, atherosclerosis, and impaired retinal perfusion. The ensuring retinal pathology occurs progressively because of impaired perfusion and chronic hypertension. Arteriovenous nicking, copper wiring, cotton-wool spots, exudates, and flame hemorrhages are seen on funduscopy depending on the severity of disease.

Idiopathic retinal artery thrombosis (Choice D) may cause transient or permanent retinal artery occlusion and present with acute, painless, monocular vision loss. This would likely occur because of atherosclerotic disease of the native retinal artery with in situ thrombosis, whereas carotid atherosclerosis would result in embolic spread to the retinal artery.

Mural thrombus in the left ventricle (Choice E) increases risk for thromboembolic disease to the central nervous system. While this could result in monocular or binocular vision loss, the inciting occlusion would typically be a thrombus, not a cholesterol embolus.

48. A previously healthy 25-year-old woman is brought to the emergency department 20 minutes after being struck by an automobile. On arrival, she has pelvic and left lower extremity pain. Her temperature is 36.8°C (98.3°F), pulse is 135/min, respirations are 26/min, and blood pressure is 90/48 mm Hg. Examination shows an unstable pelvis and an obvious deformity of the left thigh. X-rays show fractures of the left iliac wing and left midshaft femur. Ten units of packed red blood cells are administered, and her blood pressure stabilizes. Nine days after operative repair of her fractures, she develops jaundice. Abdominal examination shows no abnormalities. Serum studies show:

Bilirubin, total	5 mg/dL
Direct	2.3 mg/dL
Alkaline phosphatase	150 U/L
γ-Glutamyltransferase	35 U/L (N=5–50)

Which of the following is the most likely underlying cause of these findings?

A) Decreased excretion of bilirubin into the bile
B) Decreased hepatic conjugation of bilirubin
C) Decreased hepatic uptake of bilirubin
D) Obstruction of common bile duct
E) Overproduction of bilirubin

Correct Answer: E.

Overproduction of bilirubin occurs in the setting of hematoma resorption or red blood cell hemolysis. The patient presents following trauma with pelvic and femur fractures, requiring red blood cell transfusion. This indicates her traumatic injuries likely resulted in hemorrhage and/or hematoma formation in the acute setting, manifesting as hemorrhagic shock. Following stabilization, she subsequently developed jaundice as a result of digestion and resorption of the blood products within her traumatic hematomas. As the blood cells are digested, hemoglobin is metabolized into biliverdin and bilirubin. Large quantities of blood cells in the setting of a pelvic or thigh hematoma may overwhelm the baseline physiologic processing capacity of the liver, which causes hyperbilirubinemia and manifests as jaundice.

Incorrect Answers: A, B, C, and D.

Decreased excretion of bilirubin into the bile (Choice A) occurs in Dubin-Johnson syndrome and Rotor syndrome, which are characterized by defective hepatocellular excretion of conjugated bilirubin into the bile canaliculi. This results in a direct hyperbilirubinemia and a grossly appearing black liver in Dubin-Johnson syndrome. These are chronic disorders and would not acutely present following trauma.

Decreased hepatic conjugation of bilirubin (Choice B) occurs in Gilbert syndrome where there is mildly decreased conjugation and impaired bilirubin uptake, and also in Crigler-Najjar syndrome, where there is complete absence of bilirubin conjugation. Gilbert syndrome can present with an indirect hyperbilirubinemia following a stress event, while Crigler-Najjar presents with severe indirect hyperbilirubinemia that results in jaundice, failure to thrive, and kernicterus in infants, requiring phototherapy and plasmapheresis.

Decreased hepatic uptake of bilirubin (Choice C) occurs to a mild extent in Gilbert syndrome, which is characterized by transient episodes of mild jaundice in response to fasting and stress.

Obstruction of the common bile duct (Choice D) can occur in the setting of obstructive choledocholithiasis, pancreatic head carcinoma, cholangiocarcinoma, or ampullary carcinoma. It typically presents with a direct hyperbilirubinemia, along with other symptoms related to the underlying cause. It would not typically be associated with the acute post-traumatic setting.

49. Two weeks ago, a 37-year-old woman noticed a small painless sore on her right thigh that now measures 2 cm in diameter. She has a 9-year history of chronic ulcerative colitis, for which she takes sulfasalazine. She currently has 3 to 4 semiformed stools daily. The ulcer has sharply defined edges and a flat base containing purulent debris. Which of the following is the most likely explanation?

A) Allergic drug reaction
B) Erythema nodosum
C) Infarction
D) Necrobiosis
E) Pyoderma gangrenosum

Correct Answer: E.

Pyoderma gangrenosum (PG) is an uncommon dermatologic condition associated with ulcerative colitis and inflammatory systemic disease. PG is a neutrophilic dermatosis that presents with the onset of a papule or pustule that often progresses to a painful ulcer with sharply defined edges and a purulent base. It may demonstrate pathergy, wherein new PG lesions arise following minor injury to otherwise intact skin. In rare cases, it can present with extracutaneous neutrophilic infiltrates in organ systems. Diagnosis requires the exclusion of similar dermatologic conditions including infection, malignancy, vascular-insufficiency ulcers, and trauma. No specific diagnostic study is indicated for the evaluation of pyoderma gangrenosum, although tissue biopsy may be needed in cases of clinical uncertainty.

Incorrect Answers: A, B, C, and D.

Allergic drug reactions (Choice A) typically present with acute, diffuse erythematous and pruritic rashes following exposure to a drug. While this patient did take sulfasalazine, this rash has progressed over the course of two weeks with the development of an ulcerative lesion, which is less consistent with allergic drug reaction.

Erythema nodosum (Choice B) is an inflammatory panniculitis that is often associated with chronic inflammatory diseases (e.g., sarcoidosis or ulcerative colitis), infections (e.g., streptococcus), or medication reactions (e.g., sulfonamides). It typically presents with painful, erythematous nodules along the anterior aspect of the shins, without ulceration.

Infarction (Choice C) of the skin can occur in the setting of protein C or S deficiency after the administration of warfarin. During the initiation of warfarin, the potential for a hypercoagulable state exists, especially in patients with protein C or S deficiency. This can result in warfarin-associated skin necrosis characterized by patches of necrotic skin, not ulcerations.

Necrobiosis (Choice D) lipoidica is a rare dermatologic condition that often affects the shins. It is a chronic granulomatous skin disease that is associated with diabetes mellitus. It typically presents with reddish or violaceous papules that progress to yellow-brown telangiectatic plaques. Ulceration of the lesions can occur.

50. An 87-year-old woman is brought to the emergency department from a skilled nursing care facility because of a change in mental status during the past 12 hours. She has severe dementia, Alzheimer type, and is unable to give a history. She is currently taking donepezil, atenolol, digoxin, lisinopril, sertraline, docusate, psyllium, and aspirin. On arrival, she is agitated and does not respond to verbal stimuli. Her temperature is 38°C (100.4°F), pulse is 92/min, respirations are 24/min, and blood pressure is 148/86 mm Hg. The lungs are clear to auscultation. The abdomen is distended. There is diffuse guarding with no rebound. Test of the stool for occult blood is negative. Her hematocrit is 34%, leukocyte count is 9500/mm^3, and platelet count is 267,000/mm^3. An x-ray of the abdomen is shown. Which of the following is the most appropriate next step in management?



A) Serial measurement of cardiac enzyme activities
B) CT scan of the abdomen
C) Discontinuation of sertraline
D) Sigmoidoscopy-guided placement of a rectal tube
E) Exploratory laparotomy

Correct Answer: D.

Initial management of a sigmoid volvulus includes sigmoidoscopy-guided placement of a rectal tube. A sigmoid volvulus results from twisting of the sigmoid mesentery which can lead to large bowel obstruction and perforation or intestinal necrosis if not treated. Patients commonly present with symptoms secondary to a large bowel obstruction such as constipation, abdominal bloating, distention, nausea, and vomiting. Sigmoid volvulus typically demonstrates a coffee-bean appearance on abdominal x-rays with severe distention of the sigmoid colon. In patients without complications such as bowel ischemia or perforation, treatment requires detorsion of the sigmoid colon and mesentery through sigmoidoscopy with placement of a rectal tube to facilitate stool passage and maintain decompression. Recurrent sigmoid volvulus may require surgical colopexy or sigmoid colectomy.

Incorrect Answers: A, B, C, and E.

Serial measurement of cardiac enzyme activities (Choice A) would be indicated for evaluation of potential acute coronary syndrome to evaluate progression of myocardial ischemia or infarction. This is not indicated in the setting of sigmoid volvulus.

CT scan of the abdomen (Choice B) may be performed if there is doubt about the diagnosis following x-ray. Given the patient's physical examination along with a coffee-bean sign and severe distention of the sigmoid colon on the x-ray, a CT scan is unnecessary.

Discontinuation of sertraline (Choice C) is unnecessary as this patient's altered mental status and presentation are secondary to a sigmoid volvulus, which has no association with selective serotonin reuptake inhibitors.

Exploratory laparotomy (Choice E) is not indicated for the first-line management of sigmoid volvulus without intestinal necrosis or perforation.