1. A 42-year-old woman has the onset of chills 2 hours after transfusion of 2 units of packed red blood cells. She has a 1-week history of fatigue and shortness of breath with exertion; her hemoglobin concentration prior to the transfusion was 8.2 g/dL. Her temperature now is 38.5°C (101.3°F). The remainder of the examination shows no abnormalities. Her hemoglobin concentration now is 10 g/dL. Which of the following is the most likely explanation for this patient's fever?

A) Bacterial contamination of the transfused blood
B) Hemolytic transfusion reaction
C) HIV infection from the transfused blood
D) IgA deficiency
E) Release of cytokines from the transfused blood

Correct Answer: E.

Release of cytokines from the transfused blood is the most likely cause of this patient's fever following the transfusion of packed red blood cells. Transfusion reactions are common and can range in severity from mild discomfort (eg. itching, fever, or mild rash) to life-threatening illness (eg, hemolysis or anaphylaxis). The time course of this patient's fever (several hours after the start of the transfusion) and normal laboratory studies are consistent with an acute febrile nonhemolytic transfusion reaction (FNHTR), which is the most common type of transfusion reaction. FNHTR occurs because of the presence of preformed antibodies on donor leukocyte antigens and from cytokines in the plasma component of the transfused sample. It is typically mild in severity and resolves with supportive care. If symptoms occur during the transfusion, it should be paused to rule out ABO incompatibility. Antipyretics and consideration of other causes of fever are recommended. Recurrent FNHTR can be prevented through the transfusion of leukodepleted red blood cells.

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

Bacterial contamination of the transfused blood (Choice A) is uncommon, but all potential causes of fever should be evaluated. Bacterial infection is more common after the transfusion of platelets. Bacterial infection as a cause of fever would generally occur later than 2 hours after the start of transfusion.

Hemolytic transfusion reactions (Choice B) usually occur after clerical errors that result in the transfusion of ABO incompatible blood. In these instances, preformed antibodies against antigens on the surface of donor red blood cells leads to widespread hemolysis. This reaction is typically severe and may present with fever, flank pain, hemoglobinuria, and occasionally death.

HIV infection from the transfused blood (Choice C) is far less common in current clinical practice because of the universal screening of donated blood. Additionally, the symptoms of HIV infection would be delayed, and are unlikely to occur within 2 hours of administration of any contaminated blood products.

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C) HIV infection from the transfused blood

D) IgA deficiency

E) Release of cytokines from the transfused blood

Correct Answer: E.

Release of cytokines from the transfused blood is the most likely cause of this patient's fever following the transfusion of packed red blood cells. Transfusion reactions are common and can range in severity from mild discomfort (eg. itching, fever, or mild rash) to life-threatening illness (eg, hemolysis or anaphylaxis). The time course of this patient's fever (several hours after the start of the transfusion) and normal laboratory studies are consistent with an acute febrile nonhemolytic transfusion reaction (FNHTR), which is the most common type of transfusion reaction. FNHTR occurs because of the presence of preformed antibodies on donor leukocyte antigens and from cytokines in the plasma component of the transfused sample. It is typically mild in severity and resolves with supportive care. If symptoms occur during the transfusion, it should be paused to rule out ABO incompatibility. Antipyretics and consideration of other causes of fever are recommended. Recurrent FNHTR can be prevented through the transfusion of leukodepleted red blood cells.

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HIV infection from the transfused blood (Choice C) is far less common in current clinical practice because of the universal screening of donated blood. Additionally, the symptoms of HIV infection would be delayed, and are unlikely to occur within 2 hours of administration of any contaminated blood products.

IgA deficiency (Choice D) can lead to anaphylaxis secondary to pre-formed antibodies against donor immunoglobulins and can be prevented by washing out as much plasma as possible from donor red blood cells. This patient does not have signs or symptoms of anaphylaxis.

Educational Objective: Acute febrile nonhemolytic transfusion reactions are the most common type of transfusion reaction and typically resolve with supportive care. These reactions occur as a result of preformed antibodies on leukocyte antigens and cytokines from the donor plasma.

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2. Twelve hours after admission to the hospital for evaluation of a right lower quadrant abdominal mass, a 77-year-old woman has dyspnea. On admission, hemoglobin concentration was 6 g/dL. CT scan of the abdomen showed a 10-cm complex mass of the cecum. The stool was brown and tested positive for occult blood. She has received 3 units of packed red blood cells since admission. Pulse is 120/min, respirations are 20/min, and blood pressure is 130/90 mm Hg. Pulse oximetry on 2 L/min of oxygen via nasal cannula shows an oxygen saturation of 92%. Crackles are heard bilaterally. Abdominal examination shows no tenderness. ECG shows sinus tachycardia. Which of the following is most likely to confirm the cause of this patient's respiratory distress?

A) Arterial blood gas analysis
B) Dipyridamole-thallium scan
C) Post-transfusion crossmatch
D) Ventilation-perfusion lung scans
E) X-ray of the chest

Correct Answer: E.

An x-ray of the chest is most likely to confirm the cause of this patient's respiratory distress. Most causes of acute dyspnea can be determined with a careful history, physical examination, chest x-ray, ECG, and blood gas analysis. In this case, the important history includes dyspnea that began after admission and following transfusion of three units of packed red blood cells. The physical examination discloses tachycardia, hypoxemia, and crackles on pulmonary auscultation. Given these findings, a chest x-ray will likely display pulmonary edema and vascular congestion associated with transfusion-induced hypervolemia, more commonly referred to as transfusion-associated circulatory overload (TACO). In this syndrome, patients typically develop shortness of breath, tachycardia, and pulmonary edema within 6 hours of receiving a significant volume of blood products. Risk factors for TACO include renal dysfunction, heart disease, extremes of age, hypoalbuminemia, and a positive fluid balance prior to transfusion. Management includes discontinuing any current transfusions, placing the patient in an upright sitting position if tolerated, providing supplemental oxygen, and administering diuretics. Occasionally, positive pressure ventilation may be required in severe cases.

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

Arterial blood gas analysis (Choice A) is often useful in determining the cause of acute dyspnea, as it provides information on oxygenation, ventilation, and acid-base status. However, in this case, the history and physical examination findings are suggestive of a volume overloaded state, and a chest x-ray is more likely to confirm the diagnosis.

Dipyridamole-thallium scan (Choice B) is used to evaluate myocardial perfusion in a non-exercise stress test. The temporal association between the patient's symptoms and the recent transfusion argue against myocardial ischemia as the cause of the patient's presentation.

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Correct Answer: E.

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Dipyridamole-thallium scan (Choice B) is used to evaluate myocardial perfusion in a non-exercise stress test. The temporal association between the patient's symptoms and the recent transfusion argue against myocardial ischemia as the cause of the patient's presentation.

Post-transfusion crossmatch (Choice C), utilizing a blood sample from the patient as well as the transfusion bag and intravenous tubing, if possible, is indicated for workup of a transfusion reaction to determine if an incompatible transfusion product was administered. TACO does not result from blood incompatibility, and the post-transfusion crossmatch will not confirm the diagnosis.

Ventilation-perfusion lung scans (Choice D) are useful in the evaluation for acute pulmonary embolism in patients who cannot tolerate a contrasted CT scan. They are also routinely ordered in the evaluation of pulmonary hypertension to assess for chronic pulmonary thromboembolic disease. However, they would not provide useful information on volume status in this acute setting.

Educational Objective: Transfusion-associated circulatory overload is a relatively common transfusion reaction that occurs when the rapid increase in intravascular volume overwhelms the circulatory system. Patients develop dyspnea, edema, increased jugular venous pressure, and manifestations of hypervolemia. Management is handled with supportive care and diuretics.

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3. A 36-year-old woman is admitted to the hospital because of bleeding in the upper gastrointestinal tract for 4 hours. Three months ago, she was hospitalized for 20 days for treatment of necrotizing pancreatitis secondary to choledocholithiasis. Four weeks ago, she was admitted for a similar episode of bleeding. Her temperature is 37.3°C (99.1°F), pulse is 110/min, and blood pressure is 110/70 mm Hg. The abdomen is soft with active bowel sounds. Endoscopy shows bleeding from gastric varices. The bleeding resolves with conservative treatment. Which of the following is the most likely cause of the bleeding?

A) Alcoholic hepatitis
B) Cirrhosis of the liver
C) Fatty infiltration of the liver
D) Hepatic vein thrombosis
E) Splenic vein thrombosis

Correct Answer: E.

The patient's presentation is most likely caused by splenic vein thrombosis resulting in variceal formation and subsequent upper gastrointestinal bleeding. The abdominal organs drain venous blood via both a systemic route (draining directly into the inferior vena cava) and the portal route (draining into the hepatic portal vein, then passing through the liver before entering the inferior vena cava). In the portal system, the inferior mesenteric veins and short gastric veins drain into the splenic vein, which then combines with the superior mesenteric vein to form the portal vein. Thrombosis in the portal system in this region is a potential complication of pancreatitis due to perivenous inflammation as the splenic vein lies in anatomic proximity to the pancreas. Clinical manifestations depend on the location of the thrombus. For this patient, a thrombus in the splenic vein led to venous congestion in the draining gastric veins and formation of gastric varices. In addition to gastrointestinal bleeding, other complications of splenic vein thrombosis can include hypersplenism, thrombocytopenia, intestinal ischemia, and increased risk of abdominal infection.

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

Alcoholic hepatitis (Choice A) is characterized by jaundice, systemic inflammatory response (tachycardia, tachypnea, leukocytosis), and increased serum concentrations of liver enzymes that occurs in the setting of heavy, chronic alcohol use. The patient may also have hepatomegaly and right upper quadrant abdominal tenderness. This patient does not have a reported history of alcohol use.

Cirrhosis of the liver (Choice B) is a risk factor for variceal formation due to portal hypertension. In this case, there is no additional history to suggest development of cirrhosis, and her recent episode of necrotizing pancreatitis supports a diagnosis of splenic vein thrombosis.

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E) Splenic vein thrombosis

Correct Answer: E.

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Cirrhosis of the liver (Choice B) is a risk factor for variceal formation due to portal hypertension. In this case, there is no additional history to suggest development of cirrhosis, and her recent episode of necrotizing pancreatitis supports a diagnosis of splenic vein thrombosis.

Fatty infiltration of the liver (Choice C) is associated with excessive alcohol use, obesity, and type 2 diabetes, leading to chronic liver inflammation that may progress to cirrhosis. This patient's course is more acute in nature.

Hepatic vein thrombosis (Choice D), also called Budd-Chiari Syndrome, results in blockage of blood outflow from the liver, with development of hepatic congestion and portal hypertension. It typically presents with jaundice, abdominal pain, and abdominal distension, which are absent in this patient.

Educational Objective: Increased hydrostatic pressure and congestion in the portal venous system can lead to gastric and esophageal variceal formation, which have a high risk of life-threatening bleeding. Splenic vein thrombosis is a complication associated with pancreatitis and can lead to gastric variceal formation as some gastric veins drain into the splenic vein.

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4. An 18-year-old man is brought to the emergency department 23 minutes after being involved in a motor vehicle collision in which he was thrown from the vehicle into a tree. At the scene, his spine was immobilized with a cervical collar and backboard, and intravenous administration of fluids was begun. On arrival, he is alert. His temperature is 35.6°C (96°F), pulse is 125/min, respirations are 30/min, and palpable systolic blood pressure is 60 mm Hg. Examination shows angulation of the midthoracic spine. He is unable to move his lower extremities. X-rays of the spine show compression fractures, angulation, and obliteration of the spinal canal at T7–8. After infusion of 3 L of lactated Ringer solution over the course of 20 minutes, his pulse is 90/min and he remains hypotensive. Which of the following is the most likely cause of this patient's hypotension?

A) Decreased myocardial contractibility
B) Decreased sympathetic tone
C) Hypothermia
D) Hypovolemia
E) Increased capillary permeability

Correct Answer: B.

Neurogenic shock occurs in the setting of a catastrophic central nervous system injury such as a cervical or thoracic spinal cord injury. This causes diminished or completely absent sympathetic output to the heart and vasculature, which subsequently results in hypotension secondary to decreased myocardial contractility, bradycardia, and/or arteriolar vasodilation. Treatment requires the administration of isotonic fluids to attempt resuscitation, although this may not be sufficient to overcome the widespread arteriolar vasodilation.

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

Decreased myocardial contractibility (Choice A) describes the etiology of cardiogenic shock. Cardiogenic shock can occur in the setting of acute myocardial infarction, severe valvular dysfunction, severe heart failure, heart block, or arrhythmia. Signs and symptoms include hypotension, cool and pale extremities, jugular venous distention, and pulmonary edema.

Hypothermia (Choice C) can be a feature of adrenal insufficiency. Adrenal insufficiency presents with hypotension, hypothermia, hypoglycemia, weakness, and variable metabolic and acid-base derangements based on the level of the causative lesion (primary versus secondary). This patient's temperature is near-normal; hypothermia to cause profound hypotension is usually severe.

Hypovolemia (Choice D) can lead to shock secondary to a reduction in intravascular volume, commonly related to hemorrhage or dehydration, which results in decreased cardiac preload, stroke volume, and cardiac output. In turn, there is arteriolar vasoconstriction to increase systemic vascular resistance in an attempt to maintain mean arterial pressure. If

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Hypovolemia (Choice D) can lead to shock secondary to a reduction in intravascular volume, commonly related to hemorrhage or dehydration, which results in decreased cardiac preload, stroke volume, and cardiac output. In turn, there is arteriolar vasoconstriction to increase systemic vascular resistance in an attempt to maintain mean arterial pressure. If progressive and severe, this compensation response fails, which leads to the development of hypotension and inadequate organ perfusion.

Increased capillary permeability (Choice E) is observed in anaphylactic and septic shock, both forms of distributive shock also characterized by a reduction in systemic vascular resistance. This reduction in systemic vascular resistance is secondary to IgE-mediated histamine and cytokine release in anaphylactic shock, and cytokine or toxin-mediated endothelial dysfunction in septic shock.

Educational Objective: Neurogenic 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, bradycardia, and arteriolar vasodilation.

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5. A 67-year-old man comes to the physician because of low back pain for 1 week and urinary incontinence for 2 days. He is currently undergoing chemotherapy for squamous cell carcinoma of the lung with metastases to the liver. Examination shows tenderness to palpation over the lumbar spine and decreased sensation below the umbilicus. Rectal examination shows decreased sphincter tone. The prostate is diffusely enlarged. Which of the following is the most appropriate next step in diagnosis?

A) Measurement of serum prostate-specific antigen concentration
B) Urine culture
C) Cystourethrography
D) Renal ultrasonography
E) CT scan of the head
F) MRI of the spine

Correct Answer: F.

A patient with a diffusely enlarged prostate likely has prostate cancer, which often metastasizes to the lumbar spine. An occasional declaring presentation of metastatic prostate cancer is low back pain, caused by metastasis to the lumbar spine. MRI of the spine is indicated for the evaluation of acute onset neurological deterioration. Cauda equina syndrome occurs from acute compression of the cauda equina nerve roots in the lumbosacral spinal canal, most commonly from an acute disc herniation or a traumatic or pathologic vertebral column fracture. This results in bilateral lower extremity weakness, loss of deep tendon reflexes, bowel or bladder dysfunction (eg, overflow urinary incontinence), and saddle anesthesia. Emergent MRI of the lumbosacral spine is indicated to investigate the cause of cauda equina syndrome, and to determine the necessity of surgical decompression.

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

Measurement of serum prostate-specific antigen concentration (Choice A) is used as a tumor marker to monitor prostate cancer. While this patient likely has prostate cancer that has metastasized to bone, this patient's signs and symptoms of cauda equina syndrome are a surgical emergency and an MRI of the spine should be the next diagnostic step.

Urine culture (Choice B) is helpful in the diagnosis of urinary tract infections, which can present with urinary symptoms such as dysuria, frequency, and urgency. It would not cause spinal tenderness, numbness, or decreased sphincter tone, which is more indicative of a spine pathology.

Cystourethrography (Choice C) can be helpful in the diagnosis of urinary tract abnormalities, such as urethral stricture or urethral trauma, which can present with urinary retention. This patient's urinary incontinence is most likely due to spine pathology and less likely caused by a bladder or urethral anatomic abnormality

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F) MRI of the spine

Correct Answer: F.

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Renal ultrasonography (Choice D) is indicated in patients who are suspected to have postrenal obstruction causing hydronephrosis, such as nephrolithiasis or an enlarged prostate. This patient's clinical presentation is more consistent with a spine pathology.

CT scan of the head (Choice E) may be warranted as a component of a workup for intracranial pathology; however, this patient's low back pain and decreased sphincter tone localize to the spine.

Educational Objective: Prostate cancer often metastasizes to the lumbar spine. Cauda equina syndrome occurs from acute compression of the cauda equina nerve roots in the lumbosacral spinal canal and should be emergently evaluated with an MRI of the spine.

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6. A 25-year-old woman is brought to the emergency department on a backboard with her neck and head restrained after a motor vehicle collision; she was not wearing a seat belt. She is awake but confused and has no memory of the crash. Examination shows a contusion on the right side of the head and clear fluid draining from the right ear. Which of the following is the most likely explanation for these findings?

A) Comminuted skull fracture causing lymphatic disruption in the ear
B) Cranial fracture that has disrupted the meninges
C) Linear fracture of the temporomandibular joint
D) Stellate fracture of the frontoparietal bone
E) Zygomatic fracture

Correct Answer: B.

Basilar skull fractures typically occur after high-impact blunt head injuries, such as in this patient after a motor vehicle collision in which she was not wearing a seatbelt. A basilar skull fracture is defined as a fracture involving at least one of the bones that make up the base of the skull: the cribriform plate, orbital plate of the frontal bone, sphenoid bone, occipital bones, or the petrous or squamous portion of the temporal bone. In this patient with a contusion of the right side of her head and clear fluid draining from the right ear, a fracture of the temporal bone is likely. Patients with basilar skull fractures can present with hemotympanum, cerebrospinal fluid or bloody otorrhea or rhinorrhea, retroauricular and periorbital ecchymosis, and cranial nerve palsy. Cerebrospinal fluid leaks occur due to a meningeal tear of the dura, creating a communication that allows cerebrospinal fluid to flow out of the middle ear or nose.

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

A comminuted skull fracture causing lymphatic disruption in the ear (Choice A) can result in a perilymphatic fistula, which is a fistula between the fluid-filled inner ear and the middle ear. A perilymphatic fistula can cause symptoms such as the sensation of ear fullness, hearing loss, vertigo, tinnitus, and nausea.

A linear fracture of the temporomandibular joint (Choice C), stellate fracture of the frontoparietal bone (Choice D), or zygomatic fracture (Choice E) would not explain the presence of clear fluid draining from the right ear, which is likely due to a cerebrospinal fluid leak. Linear skull fractures often are simple, closed, and have minimal clinical significance. The presence of external cerebrospinal fluid drainage is concerning for a basilar skull fracture.

Educational Objective: Basilar skull fractures typically occur after high-impact, blunt head injuries. Patients can present with hemotympanum, cerebrospinal fluid or bloody otorrhea or rhinorrhea, retroauricular and periorbital ecchymosis, and cranial nerve palsy.

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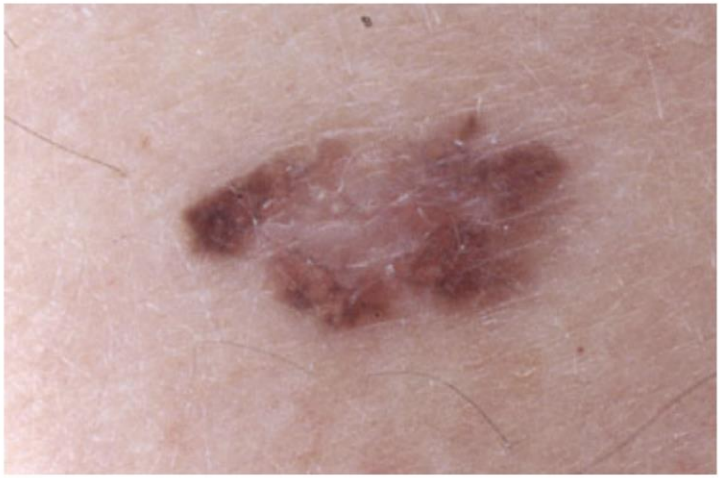
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Educational Objective: Basilar skull fractures typically occur after high-impact, blunt head injuries. Patients can present with hemotympanum, cerebrospinal fluid or bloody otorrhea or rhinorrhea, retroauricular and periorbital ecchymosis, and cranial nerve palsy.

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7. A 67-year-old woman comes to the physician because of a painless large freckle on the back of her thigh that she first noticed 1 month ago. She has no history of serious illness and takes no medications. There is no personal or family history of skin lesions. She uses sunscreen with SPF 45 regularly. The patient is fair skinned. Examination shows a 1-cm lesion above the popliteal fossa. A photograph of the lesion is shown. Which of the following is the most likely diagnosis?



A) Benign nevus
B) Keratoacanthoma
C) Melanoma
D) Seborrheic keratosis
E) Solar lentigo

Correct Answer: C.

Malignant melanoma is likely to be present when a lesion demonstrates asymmetry, irregular-appearing borders, variable coloration, a diameter greater than 6 mm, and rapid evolution in characteristics. It is a neoplasm of melanocytes, which contain pigment in melanosomes. Histologically, it may appear as dendritic cells containing pigment granules with high nuclear to cytoplasmic ratios, mitotic figures, and increased size compared to normal melanocytes. Malignant melanoma can rapidly invade and metastasize, which carries a poor prognosis when diagnosed late. Subtypes include superficial spreading, nodular, lentigo maligna, and acral lentiginous. Any lesion with features suggestive of malignant melanoma should be surgically excised with negative margins and pathologically examined for the depth of dermal invasion.

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

Benign nevus (Choice A) is a common proliferation of melanocytes located in both the epidermis and dermis. They should not display asymmetry, border irregularity, multiple colors, or rapid evolution, as this would suggest melanoma.

Keratoacanthoma (Choice B) is a cutaneous tumor characterized by a dome-shaped proliferation of keratinocytes with a central, keratin-filled crater. It typically occurs on sun-exposed areas. While most keratoacanthomas are characterized by a benign course, often undergoing spontaneous involution, some lesions progress to squamous cell carcinoma.

Seborrheic keratosis (Choice D) is a benign proliferation of the epidermal keratinocytes. Lesions are typically round, elevated, brown, or tan in color, and sharply demarcated with

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Keratoacanthoma (Choice B) is a cutaneous tumor characterized by a dome-shaped proliferation of keratinocytes with a central, keratin-filled crater. It typically occurs on sun-exposed areas. While most keratoacanthomas are characterized by a benign course, often undergoing spontaneous involution, some lesions progress to squamous cell carcinoma.

Seborrheic keratosis (Choice D) is a benign proliferation of the epidermal keratinocytes. Lesions are typically round, elevated, brown, or tan in color, and sharply demarcated with an adherent or stuck on appearance. The main risk factor for seborrheic keratosis is increasing age. Treatment is not usually required.

Solar lentigo (Choice E) are benign, age-related, acquired proliferations of normal melanocytes. They typically occur in elderly patients with a history of sun exposure. These lesions lack the high-risk characteristics that are typical of malignant melanoma.

Educational Objective: Malignant melanoma is a neoplasm of melanocytes, which microscopically may appear as dendritic cells containing pigment granules with high nuclear to cytoplasmic ratios, mitotic figures, and increased size compared to normal melanocytes. Lesions classically demonstrate asymmetry, irregular-appearing borders, variable coloration, a diameter greater than 6 mm, and rapid evolution in characteristics.

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8. A 65-year-old man comes for a follow-up examination 1 week after excision of a small raised lesion with pearly margins from the lateral left naris. The pathology confirms basal cell carcinoma with the tumor extending to the resection margin in one section. Examination shows a well-healed incision. Which of the following is the most appropriate next step in management?

A) Observation and reexamination in 6 months
B) Laser therapy to the incision
C) Radiation therapy to the nose
D) Reexcision of the excision site
E) Cervical lymph node dissection

Correct Answer: D.

Basal cell carcinoma is the most common form of skin cancer and is derived from the basal cells of the epidermis. The primary risk factor for developing basal cell carcinoma is ultraviolet light exposure, though age, fair skin, and family history also contribute. Basal cell carcinomas typically present as pink, pearly papules or nodules with rolled borders and central ulceration most commonly on sun-exposed areas of the head and neck. Subtypes of basal cell carcinoma include those that are less invasive, such as superficial and nodular, and those that are more invasive, such as infiltrative and morpheaform. In all subtypes, the risk of metastasis is low, though the tumors can invade locally and cause significant tissue damage. Biopsy may be performed with a variety of techniques, including excisional, shave, or punch biopsy. Treatment of basal cell carcinoma requires complete surgical removal, either via excision or Mohs micrographic surgery. In the case of incomplete excision, re-excision with negative biopsy margins is indicated to reduce the risk of metastasis.

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

Observation and reexamination in 6 months (Choice A) is inappropriate. Complete excision with negative margins is required for definitive treatment of basal cell carcinoma. Delay of repeat excision increases the likelihood of tumor recurrence and metastasis.

Laser therapy to the incision (Choice B) is incorrect. While electrodessication and curettage, as well as photodynamic therapy, are often used to treat basal cell carcinoma, laser therapy is not commonly employed and is inadequate in the setting of a prior excisional biopsy with a positive margin.

Radiation therapy to the nose (Choice C) is not necessary. Radiotherapy is typically reserved for older patients or those in which the anatomical location of the lesion renders complete surgical excision impossible. This patient would more greatly benefit from repeat excision.

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E) Cervical lymph node dissection

Correct Answer: D.

Basal cell carcinoma is the most common form of skin cancer and is derived from the basal cells of the epidermis. The primary risk factor for developing basal cell carcinoma is ultraviolet light exposure, though age, fair skin, and family history also contribute. Basal cell carcinomas typically present as pink, pearly papules or nodules with rolled borders and central ulceration most commonly on sun-exposed areas of the head and neck. Subtypes of basal cell carcinoma include those that are less invasive, such as superficial and nodular, and those that are more invasive, such as infiltrative and morpheaform. In all subtypes, the risk of metastasis is low, though the tumors can invade locally and cause significant tissue damage. Biopsy may be performed with a variety of techniques, including excisional, shave, or punch biopsy. Treatment of basal cell carcinoma requires complete surgical removal, either via excision or Mohs micrographic surgery. In the case of incomplete excision, re-excision with negative biopsy margins is indicated to reduce the risk of metastasis.

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Radiation therapy to the nose (Choice C) is not necessary. Radiotherapy is typically reserved for older patients or those in which the anatomical location of the lesion renders complete surgical excision impossible. This patient would more greatly benefit from repeat excision.

Cervical lymph node dissection (Choice E) is not usually required in the setting of basal cell carcinoma, although it is sometimes employed when there is concern for metastatic disease associated with oral or oropharyngeal squamous cell carcinoma.

Educational Objective: Basal cell carcinoma is the most common form of skin cancer and presents as pink, pearly papules or nodules with rolled borders and central ulceration most commonly on sun-exposed areas of the head and neck. In all subtypes, the risk of metastasis is low, though the tumors can invade locally and cause significant tissue damage. Treatment requires surgical removal, either via excision or Mohs micrographic surgery. In the case of incomplete excision, re-excision with negative biopsy margins is indicated to reduce the risk of metastasis.

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9. A 57-year-old man is brought to the emergency department 30 minutes after sustaining burns over 40% of his total body surface area in a house fire. His pulse is 110/min, respirations are 22/min, and blood pressure is 120/70 mm Hg. The burned surface is anesthetic and covered with a thick, firm, brownish eschar; thrombosed vessels are visible through the burn surface. Over the next 24 hours, which of the following is the most urgent priority in management for this patient?

A) Hyperbaric oxygen therapy
B) Administration of tetanus toxoid
C) Intravenous fluid resuscitation
D) Broad-spectrum antibiotic therapy
E) Excision and grafting

Correct Answer: C

Intravenous fluid resuscitation is the most urgent priority in management of this patient with a severe, full-thickness burn, which is often classified as a burn involving more than 20% of the total body surface area (TBSA) in adults. Severe burns can result in numerous complications, including compartment syndrome secondary to circumferential eschar formation, acute kidney injury, coagulopathy, and infection, but the priority within the first 24 hours is to replace the extensive fluid losses that occur during and immediately after a serious burn. The Parkland formula, which is calculated using the weight of the patient in kilograms and the percent of TBSA burned, is often used to calculate the estimated fluid requirements in the first 24 hours. Fifty percent of the total fluid requirements are given in the first 8 hours after the burn, and the rest is given over the next 16 hours. Ongoing fluid resuscitation following the first 24 hours is usually titrated to urine output, with a goal of 0.5 to 1 mL/kg/hr. Subsequent management should focus on providing temporary coverage of burned areas, ensuring adequate nutrition, managing pain, and treating or preventing complications such as compartment syndrome and infection.

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

Hyperbaric oxygen therapy (Choice A) has not been shown to improve outcomes in burn victims in acute settings, although it is sometimes used later in the course for compromised skin grafts. The most common use of hyperbaric oxygen therapy is for the treatment of carbon monoxide poisoning and dive-related injuries such as decompression sickness.

Administration of tetanus toxoid (Choice B) vaccine is important for all patients with any burn that is more than superficial if their tetanus vaccine status needs to be updated, but it is less critical than immediate fluid resuscitation in a severely burned patient.

Broad-spectrum antibiotic therapy (Choice D) as a prophylactic measure is not indicated in patients with severe burns. Although many of these patients may develop infections during their treatment and recovery, the use of broad-spectrum antibiotics in the absence of suspected or proven infection does not improve outcomes.

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C) Intravenous fluid resuscitation

D) Broad-spectrum antibiotic therapy

E) Excision and grafting

Correct Answer: C

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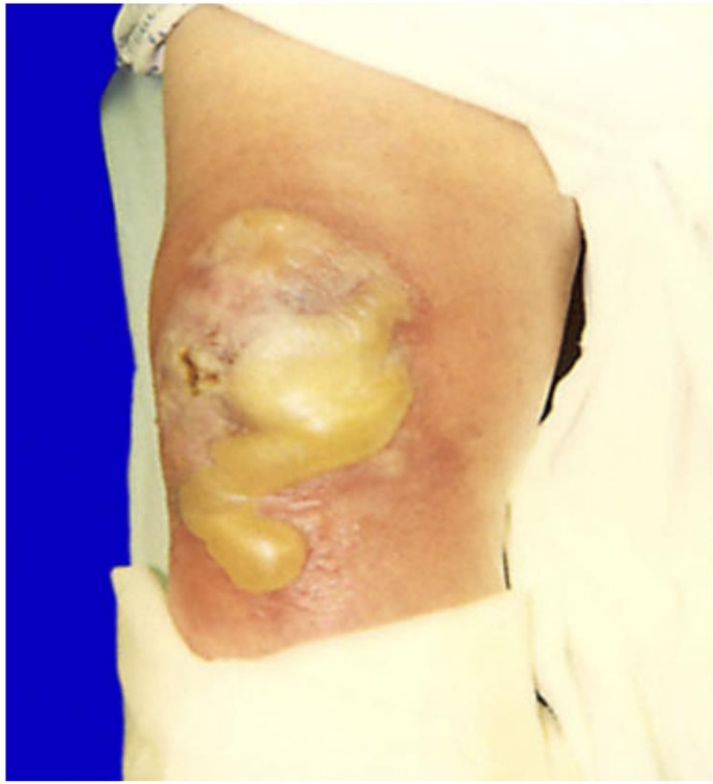
Broad-spectrum antibiotic therapy (Choice D) as a prophylactic measure is not indicated in patients with severe burns. Although many of these patients may develop infections during their treatment and recovery, the use of broad-spectrum antibiotics in the absence of suspected or proven infection does not improve outcomes.

Excision and grafting (Choice E) may be performed within the first 24 to 72 hours using a variety of techniques, but is not the initial priority in patients with severe burns.

Educational Objective: Severe burns result in substantial fluid loss, which can subsequently lead to profound multi-organ dysfunction or death if not treated aggressively within the first 24 hours. The Parkland formula, which is calculated using the TBSA burned and the patient's weight, is frequently used to provide an estimate of fluid requirements in the first 24 hours.

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10. A 47-year-old man comes to the emergency department 3 days after he sustained a painful injury to his right knee in a fall. He explains that he thought he had only scraped his knee but that the wound has been getting progressively worse. He has a 20-year history of type 2 diabetes mellitus well controlled with insulin. His most recent tetanus vaccination was 3 years ago. His temperature is 38.4°C (101.1°F), pulse is 100/min and regular, respirations are 12/min, and blood pressure is 155/60 mm Hg. A photograph of the right knee is shown. Palpation of the affected knee produces pain and crepitation. An x-ray of the right knee shows gas in the soft tissue and no bony abnormalities. Analgesic therapy is begun, and urgent surgical debridement is planned. Which of the following is the most appropriate next step in management?



A) MRI of the knee
B) Application of silver sulfadiazine
C) Antibiotic therapy
D) Corticosteroid therapy
E) Administration of tetanus toxoid
F) Hyperbaric oxygen therapy

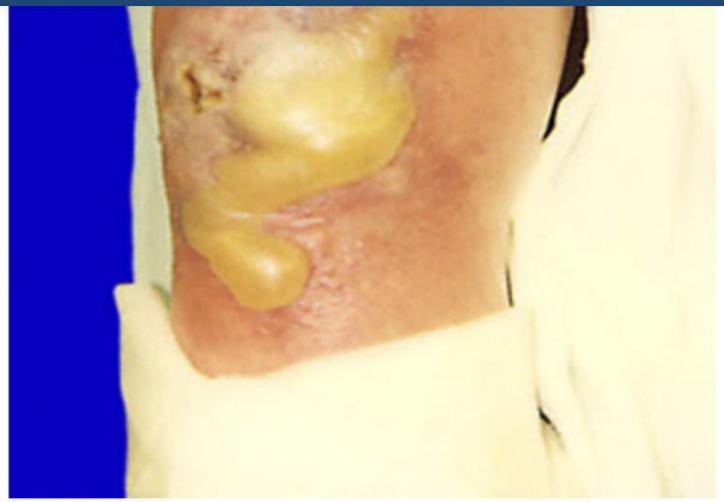
Correct Answer: C.

Antibiotic therapy is the most appropriate next step in management of this patient with evidence of necrotizing fasciitis, an infection typically caused by *Streptococcus pyogenes* or a mixture of aerobic and anaerobic bacteria, although singular organisms such as *Clostridium perfringens* or *Staphylococcus aureus* are sometimes encountered. Necrotizing fasciitis refers to infection spreading along a deep fascial plane that presents with acute onset of pain out of proportion to examination findings, erythema, and paresthesia, which progresses to anesthesia, typically occurring at a site of prior trauma or surgery. Risk factors include trauma and underlying chronic systemic illnesses, such as diabetes mellitus, liver failure, or renal failure. As the bacterial infection spreads along the deep fascial planes, bullae with or without crepitus may develop. The extent of infection is often difficult to assess by examination alone, although x-rays may disclose the presence of gas in the soft tissues. Treatment requires broad spectrum antibiotics, fluid resuscitation, and emergent debridement of the infected tissue. Often, multiple sequential debridements for definitive management are required. Empiric antibiotics usually include vancomycin with piperacillin-

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next step in management?

A) MRI of the knee
B) Application of silver sulfadiazine
C) Antibiotic therapy
D) Corticosteroid therapy
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F) Hyperbaric oxygen therapy



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

MRI of the knee (Choice A) is unnecessary and will lead to a delay in treatment for this patient. Necrotizing fasciitis is a clinical diagnosis and does not require any imaging prior to surgical intervention and antibiotic therapy.

Application of silver sulfadiazine (Choice B) is used for the treatment of burns and would not be helpful for this patient with a severe necrotizing infection. Early administration of intravenous antibiotics is paramount.

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Antibiotic therapy is the most appropriate next step in management of this patient with evidence of necrotizing fasciitis, an infection typically caused by *Streptococcus pyogenes* or a mixture of aerobic and anaerobic bacteria, although singular organisms such as *Clostridium perfringens* or *Staphylococcus aureus* are sometimes encountered. Necrotizing fasciitis refers to infection spreading along a deep fascial plane that presents with acute onset of pain out of proportion to examination findings, erythema, and paresthesia, which progresses to anesthesia, typically occurring at a site of prior trauma or surgery. Risk factors include trauma and underlying chronic systemic illnesses, such as diabetes mellitus, liver failure, or renal failure. As the bacterial infection spreads along the deep fascial planes, bullae with or without crepitus may develop. The extent of infection is often difficult to assess by examination alone, although x-rays may disclose the presence of gas in the soft tissues. Treatment requires broad spectrum antibiotics, fluid resuscitation, and emergent debridement of the infected tissue. Often, multiple sequential debridements for definitive management are required. Empiric antibiotics usually include vancomycin with piperacillin-tazobactam for broad coverage in addition to clindamycin to inhibit toxin production in cases of monomicrobial infection with *Clostridium perfringens* or *Streptococcus pyogenes*.

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Application of silver sulfadiazine (Choice B) is used for the treatment of burns and would not be helpful for this patient with a severe necrotizing infection. Early administration of intravenous antibiotics is paramount.

Corticosteroid therapy (Choice D) is sometimes used to treat patients with gout or pseudogout that involves the knee. This patient has evidence of infection, and the administration of corticosteroids could potentially worsen this patient's prognosis by blunting the immune system and impairing wound healing.

Administration of tetanus toxoid vaccine (Choice E) is indicated for all patients with necrotizing fasciitis if they have not received their immunization within the past 10 years, but antibiotic therapy is a far more urgent concern in this instance.

Hyperbaric oxygen therapy (Choice F) is sometimes used as an adjunct to treat necrotizing fasciitis, but urgent surgical debridement and intravenous antibiotics are the first step in treatment for this type of infection and should not be delayed.

Educational Objective: Necrotizing fasciitis is a severe and life-threatening infection that spreads rapidly along the fascial plane and can result in severe sepsis and death if not emergently treated with surgical debridement and intravenous antibiotics. Necrotizing fasciitis is typically caused by *Streptococcus pyogenes* or a mixture of aerobic and anaerobic organisms, but may also be caused by *Staphylococcus aureus* or *Clostridium perfringens*.

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11. A previously healthy 19-year-old woman is brought to the emergency department 45 minutes after sustaining an injury to her upper arm while playing ice hockey. Examination shows diffuse swelling over the upper arm; the skin is intact. There is absence of wrist extension. X-rays show a fracture of the distal humerus. Which of the following is the most likely site of nerve injury?

A) Axillary nerve
B) Median nerve above the elbow
C) Median nerve at the elbow
D) Musculocutaneous nerve above the elbow
E) Radial nerve above the elbow
F) Radial nerve at the elbow
G) Ulnar nerve above the elbow
H) Ulnar nerve at the elbow

Correct Answer: E.

The radial nerve courses posterior to the humerus at the midshaft within the radial groove. It is often injured in displaced midshaft or distal humerus fractures, with resulting wrist drop. The radial nerve supplies motor fibers to the triceps brachii and the extensor muscles within the posterior compartment of the forearm, and sensory fibers to the dorsum of the forearm, wrist, and hand. It does not innervate the intrinsic muscles of the hand. Injury to the nerve at the mid-diaphyseal or distal humerus causes extensor muscle function loss at the hand and fingers, weakness of supination, the presence of wrist drop, and sensory loss over the dorsal forearm, dorsal hand, and dorsal thumb, index, middle, and radial half of the ring finger.

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

A proximal humerus injury, such as a surgical neck fracture, can lead to axillary nerve injury (Choice A), which would result in dysfunction of the deltoid muscle and loss of sensation over the proximal lateral arm.

Median nerve injury (Choices B and C) presents with weakness involving the flexor compartment of the forearm, thenar eminence, and first two lumbrical muscles, along with diminished sensation over the volar forearm and lateral hand. This patient presents with absence of wrist extension, which is caused by a radial nerve injury.

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G) Ulnar nerve above the elbow

H) Ulnar nerve at the elbow

Correct Answer: E.

The radial nerve courses posterior to the humerus at the midshaft within the radial groove. It is often injured in displaced midshaft or distal humerus fractures, with resulting wrist drop. The radial nerve supplies motor fibers to the triceps brachii and the extensor muscles within the posterior compartment of the forearm, and sensory fibers to the dorsum of the forearm, wrist, and hand. It does not innervate the intrinsic muscles of the hand. Injury to the nerve at the mid-diaphyseal or distal humerus causes extensor muscle function loss at the hand and fingers, weakness of supination, the presence of wrist drop, and sensory loss over the dorsal forearm, dorsal hand, and dorsal thumb, index, middle, and radial half of the ring finger.

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

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The musculocutaneous nerve (Choice D) controls motor function of the biceps brachii and brachialis muscles, along with sensory innervation over the lateral forearm. Injury would result in impaired forearm flexion.

A distal humerus fracture would cause radial nerve injury above, not at the elbow (Choice F).

The ulnar nerve (Choices G and H) supplies motor fibers to the intrinsic muscles of the hand, and sensation over the anteromedial ring and small fingers and medial palm. Damage to the roots or to the nerve along its course (eg, in the cubital tunnel) can result in motor dysfunction of the fingers, and numbness or paresthesia involving the medial aspect of the upper extremity.

Educational Objective: The radial nerve can be injured with mid-diaphyseal or distal humerus fractures. This can lead to extensor muscle function loss at the hand and fingers, weakness of supination, the presence of wrist drop, and sensory loss over the dorsal forearm, dorsal hand, and dorsal thumb, index, middle, and radial half of the ring finger.

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12. An 82-year-old man is admitted to the intensive care unit after undergoing an uncomplicated, elective sigmoid colectomy for chronic diverticulitis. He is extubated and rates his pain as a 2 on a 10-point scale. He has a history of coronary artery disease. His medications are atorvastatin, metoprolol, and aspirin. His temperature is 37.2°C (99°F), pulse is 110/min, respirations are 32/min, and blood pressure is 140/80 mm Hg. Pulse oximetry on 6 L/min of oxygen by nasal cannula shows an oxygen saturation of 92%. There is jugular venous distention. Expiratory wheezes are heard at both lung bases. Which of the following is the most likely diagnosis?

A) Congestive heart failure
B) Cor pulmonale
C) Myocardial infarction
D) Pneumonia
E) Pulmonary embolism

Correct Answer: A.

The patient is displaying classic signs of acute congestive heart failure. These include tachycardia, tachypnea, hypoxemia, jugular venous distension, and end-expiratory pulmonary wheezes (sometimes referred to as a cardiac wheeze because of the association with pulmonary edema resulting from heart failure). Other signs of congestive heart failure can include shortness of breath, dyspnea on exertion, orthopnea, and production of frothy sputum in left-sided failure, while right-sided failure is characterized by an increased jugular venous pressure, hepatomegaly, ascites, and peripheral extremity edema. Anesthesia and surgery place significant stress on the body, and myocardial demand can exceed cardiac output, especially in an older patient with underlying coronary artery disease. Additionally, surgeries complicated by blood loss and fluid shifting may result in the need for administration of several liters of crystalloid or blood product to maintain hemodynamic stability. Treatment of an acute exacerbation of congestive heart failure consists of diuresis and respiratory support (eg, supplemental oxygen, positive pressure ventilation), and in more severe cases, intravenous positive inotropes and a ventricular assist device may be needed if cardiogenic shock is occurring.

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

Cor pulmonale (Choice B) describes right ventricular failure resulting from chronic pulmonary hypertension. Left ventricular contractility and afterload are not affected. The patient is not displaying signs of right heart failure.

Myocardial infarction (Choice C) can result in acute congestive heart failure if a large ventricular territory is affected; however, patients typically present with dyspnea and angina that is relieved by rest and nitroglycerin. While this patient does have a history of coronary artery disease, there is no additional evidence that his acute heart failure is caused by a myocardial infarction.

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E) Pulmonary embolism

Correct Answer: A.

The patient is displaying classic signs of acute congestive heart failure. These include tachycardia, tachypnea, hypoxemia, jugular venous distension, and end-expiratory pulmonary wheezes (sometimes referred to as a cardiac wheeze because of the association with pulmonary edema resulting from heart failure). Other signs of congestive heart failure can include shortness of breath, dyspnea on exertion, orthopnea, and production of frothy sputum in left-sided failure, while right-sided failure is characterized by an increased jugular venous pressure, hepatomegaly, ascites, and peripheral extremity edema. Anesthesia and surgery place significant stress on the body, and myocardial demand can exceed cardiac output, especially in an older patient with underlying coronary artery disease. Additionally, surgeries complicated by blood loss and fluid shifting may result in the need for administration of several liters of crystalloid or blood product to maintain hemodynamic stability. Treatment of an acute exacerbation of congestive heart failure consists of diuresis and respiratory support (eg, supplemental oxygen, positive pressure ventilation), and in more severe cases, intravenous positive inotropes and a ventricular assist device may be needed if cardiogenic shock is occurring.

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Pneumonia (Choice D) classically presents with fever, dyspnea, productive cough, and pleuritic chest pain. The diagnosis can be confirmed with chest imaging displaying a pulmonary infiltrate. This patient's presentation is not suggestive of pneumonia.

Pulmonary embolism (Choice E) presents with acute onset dyspnea and pleuritic chest pain. Asymmetric lower extremity edema may be present, indicating the presence of a deep venous thrombosis. Recent surgery is a risk factor for venous thromboembolic disease and a large embolus can cause obstructive shock due to right ventricular failure; however, the patient is not displaying signs of right heart failure.

Educational Objective: Common physical examination findings in acute congestive heart failure include increased jugular venous distention, peripheral extremity edema, ascites, hepatojugular reflex, pulmonary crackles, and an S_3 or S_4 gallop.

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13. A 30-year-old woman has had frequent palpitations and dyspnea with mild exertion for 2 days. She underwent an aortic valve replacement for rheumatic heart disease 2 years ago. She is receiving warfarin therapy. Her pulse is 80/min and regular, and blood pressure is 140/palpable mm Hg. She has pale conjunctivae. The lungs are clear to auscultation. Prosthetic heart sounds and loud systolic and diastolic murmurs are heard. There is trace edema of the lower extremities. Hematocrit is 24% with numerous schistocytes and fractured erythrocytes. Leukocyte count is 14,000/mm^3. An x-ray of the chest shows cardiomegaly without redistribution of blood flow. Which of the following is the most likely cause of this patient's condition?

A) Cor pulmonale
B) Dysfunction of the prosthetic valve
C) Pulmonary emboli
D) Ruptured papillary muscle
E) Warfarin-induced hemolytic anemia

Correct Answer: B.

This patient's presentation is most concerning for dysfunction of the prosthetic valve. There is a large difference between her systolic and diastolic blood pressures (increased pulse pressure), which is best explained by significant aortic insufficiency. This is further supported by the presence of diastolic murmurs and trace peripheral edema. During exertion, the backflow of blood results in cardiac output that is unable to match metabolic demands, accounting for her dyspnea. The presence of anemia and schistocytes is suggestive of valve-related hemolysis, which is a complication of prosthetic valves often caused by a structurally degraded, mispositioned, or leaking valve.

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

Cor pulmonale (Choice A) describes right ventricular failure resulting from chronic pulmonary hypertension. This patient does not have prominent evidence of right heart failure or pulmonary pathology.

Pulmonary emboli (Choice C) typically present with pleuritic chest pain, shortness of breath, tachycardia, tachypnea, and hypoxemia. It would be unusual for a patient taking a therapeutic dose of warfarin for a prosthetic heart valve to have a pulmonary embolism, though break-through emboli can occur. An embolus would not explain the patient's murmur or schistocytes.

Ruptured papillary muscle (Choice D) is an uncommon complication of myocardial infarction and infective endocarditis. It results in severe mitral valve regurgitation and cardiogenic shock. The severity of the presentation is not consistent with a ruptured papillary muscle.

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Ruptured papillary muscle (Choice D) is an uncommon complication of myocardial infarction and infective endocarditis. It results in severe mitral valve regurgitation and cardiogenic shock. The severity of the presentation is not consistent with a ruptured papillary muscle.

Warfarin-induced hemolytic anemia (Choice E), or drug-induced immune hemolytic anemia, would explain the patient's anemia and schistocytes on blood analysis, but would not explain the large pulse pressure or diastolic murmur.

Educational Objective: Prosthetic aortic valve dysfunction can cause potentially life-threatening aortic insufficiency and cardiogenic shock. A damaged or malfunctioning valve also increases risk for valve-related hemolytic anemia.

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14. One day after undergoing open cholecystectomy, a 47-year-old woman has increased blood pressure and moderate abdominal pain. She was not taking any medications prior to the operation. Postoperatively, she has been receiving lactated Ringer solution (125 mL/h) and patient-controlled morphine with a bolus dose of 1 mg and a maximum dose of 6 mg/h; there is a 10-minute lockout interval and no basal rate. She has been given nothing orally. She is alert and cooperative. Temperature is 37.0°C (98.6°F), pulse is 115/min, respirations are 22/min and shallow, and blood pressure is 170/90 mm Hg. Pulse oximetry on room air shows an oxygen saturation of 95%. There is no jugular venous distention or edema. Cardiopulmonary examination is normal. The abdomen is soft with moderate tenderness; movement produces pain. Bowel sounds are absent. Which of the following is the most appropriate next step in management of this patient's hypertension?

A) Increase bolus of morphine
B) Increase rate of lactated Ringer solution
C) Intravenous furosemide therapy
D) Intravenous metoprolol therapy
E) Oral hydrochlorothiazide therapy
F) Oral nifedipine therapy

Correct Answer: A.

Appropriate pain control is important in preventing postoperative complications. This patient has abdominal pain associated with hypertension, tachycardia, and respiratory splinting (eg, shallow breaths due to pain), the latter of which puts her at increased risk for atelectasis and consequent pneumonia. Patient-controlled analgesia (PCA) is a frequently used option for controlling postoperative pain with opioid analgesics, such as morphine, hydromorphone, and fentanyl. Typical PCA set-ups include a basal rate, a bolus dose with a lockout interval, and a total hourly limit. Benefits of PCA use include improved patient satisfaction, titratability, and decreased risk for sedation given the frequent, smaller boluses, as compared to larger bolus doses that would be given less frequently by nursing staff. However, PCAs are associated with an overall increase in opioid usage. Basal rates are rarely used, as they can be associated with increased respiratory depression and overdose; therefore, they are often reserved for opioid tolerant patients. Thus, in this patient with signs of uncontrolled postoperative pain, her bolus of morphine should be increased.

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

Increasing the rate of lactated Ringer solution (Choice B) is not necessary, as this patient does not demonstrate signs of hypovolemia and is already receiving adequate maintenance fluids. This patient has an appropriate blood pressure, and her tachycardia is more likely secondary to uncontrolled pain, rather than hypovolemia.

Intravenous furosemide therapy (Choice C) is not indicated in this patient. She demonstrates no signs of volume overload, such as jugular venous distention or peripheral edema

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Intravenous furosemide therapy (Choice C) is not indicated in this patient. She demonstrates no signs of volume overload, such as jugular venous distention or peripheral edema. Her hypertension is more likely secondary to uncontrolled pain, rather than volume overload.

Intravenous metoprolol therapy (Choice D) is not necessary. Beta blockers, such as metoprolol, are used to treat hypertension (not first-line) and tachyarrhythmias, such as atrial fibrillation and atrial flutter, among other conditions. They are not indicated in this patient, as her hypertension and tachycardia are more likely due to poorly controlled pain. Increasing her bolus dose of morphine would be a more appropriate next step.

Oral hydrochlorothiazide therapy (Choice E) is a thiazide diuretic used as a first-line agent for essential hypertension. This patient's hypertension, when associated with shallow breathing, tachycardia, and abdominal discomfort, is more likely caused by uncontrolled postoperative pain.

Oral nifedipine therapy (Choice F) is a calcium channel blocker commonly used to treat hypertension, particularly in pregnant patients. This patient is not receiving a high enough dose of narcotic to adequately cover her pain, leading to a sympathetic response with associated hypertension and tachycardia. Therefore, the most appropriate next step is to improve her pain management.

Educational Objective: Uncontrolled postoperative pain often presents with patient discomfort, tachycardia, tachypnea, hypertension, and respiratory splinting, particularly for thoracic and upper abdominal incisions. Adequate pain control following a surgical procedure is necessary to decrease the risk of postoperative complications, such as pneumonia. Patient-controlled analgesia is a frequently used option to provide opioid-based pain relief to patients after surgery.

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15. A 67-year-old man comes to the physician for a routine health maintenance examination. He feels well. He has hypertension well controlled with enalapril. Five years ago, he underwent coronary artery bypass grafting. He smoked two packs of cigarettes daily for 20 years but stopped smoking 20 years ago. He walks 1 mile daily. His temperature is 37°C (98.6°F), pulse is 84/min, respirations are 16/min, and blood pressure is 125/78 mm Hg. Cardiopulmonary examination shows no abnormalities. Abdominal examination shows a nontender pulsatile mass in the mid abdomen; no bruits are heard. Femoral pulses are normal. Abdominal ultrasonography shows a 4-cm aneurysm; there is no evidence of rupture. Which of the following factors provides the best rationale for serial imaging rather than surgical repair in this patient?

A) Absence of symptoms
B) Age of the patient
C) The patient's history of cardiac disease
D) The patient's history of hypertension
E) Size of the aneurysm

Correct Answer: E.

An abdominal aortic aneurysm (AAA) refers to a dilation of the abdominal aorta (> 3 cm), most commonly occurring inferior to the take-off of the renal arteries. It is often asymptomatic, although it can present with abdominal pain or hemodynamic instability if rupture has occurred. Physical examination may disclose a pulsatile abdominal mass, as in this patient, but it can also be unremarkable. Diagnosis is made with abdominal ultrasonography or CT scan. Risk factors for the development of an abdominal aortic aneurysm include advanced age, male sex, a smoking history, vascular disease, and connective tissue diseases, whereas the risk factors for rupture include current smoking, hypertension, and, most importantly, a large aneurysm size (> 5.5 cm) or rapid enlargement (> 0.5 cm over 6 months). When the risk of rupture is high, surgical repair is often recommended; if the risk of rupture is low, serial imaging is appropriate. Therefore, given this patient's history, it is most appropriate for him to undergo serial imaging, rather than surgical repair, given the size of his aneurysm.

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

Absence of symptoms (Choice A) is not often used in the decision process regarding the need for surgical repair of AAA. While symptoms may cause an aneurysm to be repaired sooner, large (> 5.5 cm) or rapidly enlarging (> 0.5 cm over 6months) aneurysms, even if asymptomatic, should be surgically repaired due to the high risk of rupture and consequent mortality.

Age of the patient (Choice B) is not a factor that is used to decide whether an AAA should undergo surgical repair or serial imaging. Patients at the extremes of age may be too frail to undergo surgical repair, and serial imaging may be more appropriate; however, age alone is not a sole factor used to determine appropriate management.

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C) The patient's history of cardiac disease
D) The patient's history of hypertension
E) Size of the aneurysm

Correct Answer: E.

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Age of the patient (Choice B) is not a factor that is used to decide whether an AAA should undergo surgical repair or serial imaging. Patients at the extremes of age may be too frail to undergo surgical repair, and serial imaging may be more appropriate; however, age alone is not a sole factor used to determine appropriate management.

The patient's history of cardiac disease (Choice C) and the patient's history of hypertension (Choice D) put him at increased risk for the development of an AAA. However, the risk of rupture is more closely related to ongoing hypertension and aneurysmal size. This patient's blood pressure is currently well-controlled, making the size of his aneurysm a more important aspect in determining whether to closely follow his aneurysm or surgically repair it.

Educational Objective: Abdominal aortic aneurysms refer to abnormal dilations of the abdominal aorta, with risk factors for development including advanced age, male sex, a smoking history, vascular disease, and connective tissue diseases. However, the risk for rupture and thus need for surgical repair is increased with current smoking, hypertension, and large (> 5.5 cm) or rapidly enlarging (> 0.5 cm over 6 months) aneurysm size. Diagnosis is made with ultrasonography or CT scan.

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16. A 30-year-old male firefighter has been hospitalized for 3 weeks for treatment of third-degree burns involving the neck, upper anterior chest, and right upper extremity. A purulent exudate is noted at an intravenous catheter site located in the proximal cephalic vein just above the left wrist. When the catheter is removed, additional purulent exudate drains from the site. Temperature is 38.7°C (101.7°F), pulse is 115/min, respirations are 18/min, and blood pressure is 105/70 mm Hg. Physical examination shows an 8-cm segment of the cephalic vein that is firm, tender, indurated, erythematous, and fluctuant. In addition to intravenous broad-spectrum antibiotics, which of the following is the most appropriate next step in management?

A) Application of a negative pressure dressing
B) Elevation of the left arm and application of warm compresses
C) Excision of the vein
D) Intravenous administration of heparin
E) Intravenous administration of tissue plasminogen activator

Correct Answer: C.

Catheter-related bloodstream infections are a common cause of fever in hospitalized patients and can be complicated by catheter-associated septic thrombophlebitis. The infected thrombus serves as a nidus for microbial proliferation and presents with fever and signs and symptoms of bacteremia. The involved vein may display erythema and induration and there may be purulent drainage from the catheter site. The diagnosis may be aided by duplex ultrasonography or with contrasted CT scan. Treatment of catheter-associated septic thrombophlebitis includes infectious source control with removal of the catheter and surgical excision of the affected vein. Intravenous antibiotics should be continued and adjusted to microbial sensitivities, when possible.

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

Application of a negative pressure dressing (Choice A) is useful in the management of a variety of wounds, including burns, pressure ulcers, and diabetic foot wounds. Their use is often contraindicated in the setting of ongoing wound infection. Additionally, a negative pressure dressing will not provide adequate source control without first removing the catheter and excising the affected vein.

Elevation of the left arm and application of warm compresses (Choice B) is inadequate for providing source control of the infected venous thrombus.

Intravenous administration of anticoagulants such as heparin (Choice D) or tissue plasminogen activator (Choice E) does not have well-established benefits in the setting of septic thrombophlebitis and is not recommended for most patients.

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

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Intravenous administration of anticoagulants such as heparin (Choice D) or tissue plasminogen activator (Choice E) does not have well-established benefits in the setting of septic thrombophlebitis and is not recommended for most patients.

Educational Objective: Catheter-associated septic thrombophlebitis is an uncommon complication of intravenous catheter placement that presents with fever and bacteremia. The involved vein may display erythema and induration, and there may be purulent drainage from the catheter site. Treatment involves infectious source control with removal of the catheter and surgical excision of the affected vein.

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17. A 58-year-old woman has had pain and tenderness of the long bones of the lower extremities, knees, and ankles for 2 months. She has smoked one pack of cigarettes daily for 30 years. She was diagnosed with squamous cell carcinoma of the lung 6 months ago. She has had rheumatoid arthritis for 15 years. She fractured her ankle in a fall 6 years ago. Examination of the lower extremities shows tenderness to palpation of the femur and tibia bilaterally and slight warmth and tenderness of the knees and ankles. X-rays show periosteal new bone formation of the femurs. Her symptoms are most likely a complication of which of the following?

A) Osteoporosis
B) Primary hyperparathyroidism
C) Prior trauma to the ankle
D) Rheumatoid arthritis
E) Squamous cell carcinoma of the lung

Correct Answer: E.

Squamous cell carcinoma of the lung is often complicated by hypercalcemia caused by paraneoplastic parathyroid hormone-related peptide (PTHrP) production. This protein acts similarly to parathyroid hormone (PTH), causing an increase in osteoclast activity via G protein coupled receptors. It also causes increased absorption of calcium in the intestine and renal tubules. Bone pain is a common manifestation. Other symptoms include abdominal discomfort, muscle pain and weakness, polyuria, and psychiatric disturbances. Hypercalcemia is also associated with hypophosphatemia, subperiosteal bone resorption, nephrolithiasis, and renal failure. Management is determined by the severity of calcium imbalance and symptoms. Asymptomatic cases are treated with oral fluid intake and reduced dietary calcium, while severe cases require hospitalization, intravenous fluid administration, and medications that inhibit bone resorption (typically bisphosphonates).

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

Osteoporosis (Choice A) is a condition of low bone mass typically occurring in postmenopausal female patients. Its prevalence increases with age and, as a result, most guidelines recommend screening for osteoporosis after age 65 years. It is often asymptomatic until a traumatic injury results in a fracture, most commonly involving the hip, distal radius, or vertebrae. The history of prior trauma to the ankle (Choice C) is associated with a fall and not suggestive of osteoporosis. Though treatment and prevention of osteoporosis involve oral calcium and vitamin D repletion, hypercalcemia would be an unusual complication of the low supplemental dosages.

Primary hyperparathyroidism (Choice B) should be considered in a patient presenting with symptoms of hypercalcemia. Causes of hypercalcemia can be categorized as either PTH-dependent or PTH-independent. In a patient with known squamous cell carcinoma of the lung, PTH-independent hypercalcemia caused by PTHrP secretion is a more likely diagnosis.

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C) Prior trauma to the ankle

D) Rheumatoid arthritis

E) Squamous cell carcinoma of the lung

Correct Answer: E.

Squamous cell carcinoma of the lung is often complicated by hypercalcemia caused by paraneoplastic parathyroid hormone-related peptide (PTHrP) production. This protein acts similarly to parathyroid hormone (PTH), causing an increase in osteoclast activity via G protein coupled receptors. It also causes increased absorption of calcium in the intestine and renal tubules. Bone pain is a common manifestation. Other symptoms include abdominal discomfort, muscle pain and weakness, polyuria, and psychiatric disturbances. Hypercalcemia is also associated with hypophosphatemia, subperiosteal bone resorption, nephrolithiasis, and renal failure. Management is determined by the severity of calcium imbalance and symptoms. Asymptomatic cases are treated with oral fluid intake and reduced dietary calcium, while severe cases require hospitalization, intravenous fluid administration, and medications that inhibit bone resorption (typically bisphosphonates).

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Rheumatoid arthritis (Choice D) has a clinical course characterized by joint destruction, periarticular bone loss, and synovial hypertrophy, along with extra-articular manifestations such as rheumatoid nodules and skin rash. Joint pain is more common than pain in the long bones.

Educational Objective: Squamous cell carcinoma is a common subtype of lung cancer and is associated with hypercalcemia caused by PTHrP production. Symptoms of hypercalcemia include bone pain, muscle weakness, central nervous system and psychiatric disturbances, abdominal discomfort, polyuria, and renal stone formation.

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18. Six days after abdominoperineal resection of the rectum for cancer, a 62-year-old woman becomes dyspneic as she walks to the bathroom. The postoperative course had been uncomplicated. Her temperature is 37.1°C (98.7°F), pulse is 135/min, respirations are 34/min, and blood pressure is 120/70 mm Hg. She is anxious and diaphoretic. The chest is clear to auscultation and there are no cardiac murmurs or gallops. There is no tenderness or edema of the lower extremities. Which of the following is the most likely cause?

A) Atelectasis
B) Congestive heart failure
C) Myocardial infarction
D) Pneumonia
E) Pulmonary embolism

Correct Answer: E.

A pulmonary embolism (PE) refers to an embolized blood clot to the pulmonary vasculature, most often from the deep veins of the lower extremities. Symptoms include dyspnea, pleuritic chest pain, hemoptysis, and, occasionally, lightheadedness or syncope. Clinical signs include tachycardia, tachypnea, hypoxia, and, if massive, hypotension. Risk factors for deep venous thrombosis (DVT) and subsequent PE include prolonged immobility, hypercoagulability, and tissue injury. Postsurgical DVT and consequent PE are common, as surgical patients, especially those with malignancy, have many of the risk factors that put them at increased risk for the development of venous stasis and clot formation. These often develop 5 to 7days after a procedure, and prophylaxis with subcutaneous heparin is frequently instituted to prevent their formation. Thus, in this cancer patient with dyspnea, tachycardia, and tachypnea 6 days following a surgical procedure, PE is the most likely diagnosis. Treatment includes therapeutic anticoagulation.

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

Atelectasis (Choice A) is unlikely to be the cause of this patient's acute shortness of breath, tachycardia, and tachypnea. While atelectasis can occur postoperatively secondary to immobility and the effects of general anesthesia, it is commonly asymptomatic or presents with mild hypoxia and dry inspiratory crackles on examination. PE is the more likely cause of this patient's tachypnea, tachycardia, and dyspnea.

Congestive heart failure (Choice B) is unlikely in this patient with no cardiac history. While congestive heart failure can cause dyspnea, it is often associated with peripheral edema, increased jugular venous distention, and crackles on pulmonary auscultation, none of which this patient exhibits.

Myocardial infarction (Choice C) can cause dyspnea, diaphoresis, anxiety, and tachycardia. However, this patient has no listed cardiac history and no current signs of chest pain or

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E) Pulmonary embolism

Correct Answer: E.

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Congestive heart failure (Choice B) is unlikely in this patient with no cardiac history. While congestive heart failure can cause dyspnea, it is often associated with peripheral edema, increased jugular venous distention, and crackles on pulmonary auscultation, none of which this patient exhibits.

Myocardial infarction (Choice C) can cause dyspnea, diaphoresis, anxiety, and tachycardia. However, this patient has no listed cardiac history and no current signs of chest pain or an anginal equivalent. Acute onset of dyspnea, tachycardia, and tachypnea following a surgical procedure in a patient with a malignancy is more likely secondary to a PE than a myocardial infarction.

Pneumonia (Choice D) can occur after surgical procedures, particularly thoracic and upper abdominal surgeries. The risk is increased in these procedures because of respiratory splinting secondary to pain, with consequent atelectasis in addition to an impaired ability to clear secretions and prevent aspiration. Pneumonia often presents with fever, dyspnea, and a cough productive of purulent sputum. This patient does not have a fever or cough, making PE more likely.

Educational Objective: The risk of pulmonary embolism, an embolized blood clot to the pulmonary vasculature, is increased with prolonged immobility, hypercoagulability, and tissue injury, all of which are present in a post-surgical patient, particularly one with malignancy. A pulmonary embolism commonly presents with dyspnea, tachycardia, tachypnea, and pleuritic chest pain. Treatment includes therapeutic anticoagulation.

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19. Two months after undergoing an orthotopic liver transplant, a 47-year-old man comes to the physician because of persistent fever and shortness of breath. He has had recurrent pleural effusions since the operation requiring aspiration; the yield of fluid has been decreasing each time. His temperature is 38°C (100.4°F), and respirations are 24/min. Breath sounds are decreased over the right hemithorax, and there is dullness to percussion. The remainder of the examination shows no abnormalities. An x-ray and a CT scan of the chest are shown. Which of the following is the most likely diagnosis?

A) Chronic atelectasis
B) Empyema
C) Lung abscess
D) Mesothelioma
E) Persistent pneumothorax

Correct Answer: B.

The chest x-ray shows reduced lung volumes with a large region of consolidation and effusion in the right lung base and periphery. This is further reflected in the CT scan as a

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Correct Answer: B.

The chest x-ray shows reduced lung volumes with a large region of consolidation and effusion in the right lung base and periphery. This is further reflected in the CT scan as a loculated, heterogeneous fluid collection consistent with an empyema. Empyema is an accumulation of pus within the pleural space that commonly presents with fever, progressive cough, and shortness of breath. The patient has had recurrent pleural effusions following his liver transplant, likely due to regional inflammation and disruption of the right hemidiaphragm. A pleural effusion is at risk of becoming seeded with bacteria, which may lead to empyema, frank pus in the pleural space. This patient is at increased risk of infection from common and uncommon organisms due to immunosuppression related to his organ transplant. Management of complicated effusions and empyema requires source control with chest tube placement and drainage as well as antibiotics.

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

Chronic atelectasis (Choice A) can have a varied appearance on chest imaging depending on the underlying etiology. On CT scan of the chest, the collapsed portion of lung parenchyma will frequently have a more homogeneous appearance, as opposed to the varying densities observed in this patient's imaging.

Lung abscess (Choice C) typically appears as a cavitary lesion on chest imaging with an air-fluid level. Patients will present with fever, malaise, and cough with sputum production (which is often foul-smelling).

Mesothelioma (Choice D) classically presents with chronic cough and shortness of breath. Malignant mesothelioma is associated with recurrent pleural effusions caused by inflammation and disruption of the pleura; however, a calcified pleural plaque is typically observed on chest imaging. The history of recent surgery preceding development of the

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C) Lung abscess
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Correct Answer: B.

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Mesothelioma (Choice D) classically presents with chronic cough and shortness of breath. Malignant mesothelioma is associated with recurrent pleural effusions caused by inflammation and disruption of the pleura; however, a calcified pleural plaque is typically observed on chest imaging. The history of recent surgery preceding development of the pleural effusions makes malignancy less likely.

Persistent pneumothorax (Choice E) is defined as an air leak that lasts for more than 2 days. A pneumothorax on chest imaging will appear black and line the outside of the lung tissue.

Educational Objective: Infection of a pleural effusion can result in empyema, which requires management with tube thoracostomy or surgical drainage. Empyema appears as a complex, loculated, unilateral fluid collection on chest imaging, with compression of the adjacent lung parenchyma.

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20. A 16-year-old boy is brought to the emergency department after a motor vehicle collision; he was not wearing a seat belt and struck his chest on the dashboard. Examination shows a fracture of the right arm; an x-ray of the chest shows minimal haziness in the right midlung field. Forty-eight hours later, he has a cough, and crackles are heard on auscultation. He is afebrile. A repeat x-ray shows confluent infiltrates over the left and right upper lobes. Which of the following is the most likely explanation for these findings?

A) Anaerobic pneumonitis
B) Aspiration pneumonia
C) Fat embolism
D) Lung contusion
E) Thromboembolism

Correct Answer: D.

Pulmonary contusions may occur after blunt or penetrating trauma to the chest. They often underlie the region of trauma to the chest wall and result from damage to capillaries with associated leakage of fluid into the pulmonary interstitium and alveolar spaces. This can result in hypoxemia if it involves and compromises a large enough region of the lung. On chest x-rays, pulmonary contusions appear as interstitial infiltrates and/or patchy alveolar opacities. The extent and distribution depend on the mechanism, location, and force of trauma to the chest wall. Management of pulmonary contusions is supportive with control of pain, pulmonary toilet, lung expansion, and maintenance of adequate ventilation/oxygenation of the patient.

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

Anaerobic pneumonitis (Choice A) refers to an acute irritant injury of the pulmonary alveoli and airways caused by inhalation of gastric contents. It presents similarly to aspiration pneumonia with pain, shortness of breath and cough, but is distinguished from aspiration pneumonia by lack of fever, though there is substantial clinical overlap in the presentations. Radiographic appearance is variable and may range from ground glass opacity to focal consolidation.

Aspiration pneumonia (Choice B) is characterized by fever, cough productive of foul-smelling sputum, malaise, and chest discomfort following an aspiration event. 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 prone or supine. Focal consolidation is typically visible on x-ray.

Fat embolism (Choice C) typically occurs acutely following a long bone fracture with resultant fever, tachycardia, tachypnea, hypoxia, petechiae, and conjunctival hemorrhage.

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C) Fat embolism
D) Lung contusion
E) Thromboembolism

Correct Answer: D.

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Anaerobic pneumonitis (Choice A) refers to an acute irritant injury of the pulmonary alveoli and airways caused by inhalation of gastric contents. It presents similarly to aspiration pneumonia with pain, shortness of breath and cough, but is distinguished from aspiration pneumonia by lack of fever, though there is substantial clinical overlap in the presentations. Radiographic appearance is variable and may range from ground glass opacity to focal consolidation.

Aspiration pneumonia (Choice B) is characterized by fever, cough productive of foul-smelling sputum, malaise, and chest discomfort following an aspiration event. 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 prone or supine. Focal consolidation is typically visible on x-ray.

Fat embolism (Choice C) typically occurs acutely following a long bone fracture with resultant fever, tachycardia, tachypnea, hypoxia, petechiae, and conjunctival hemorrhage.

Thromboembolism (Choice E) presents with tachycardia, tachypnea, and pleuritic chest pain, and is unlikely to be related to trauma acutely, though can result from prolonged immobilization following trauma if a thrombus develops and embolizes.

Educational Objective: Pulmonary contusions may occur after blunt or penetrating trauma to the chest. On chest x-ray, pulmonary contusions appear as interstitial infiltrates and/or patchy alveolar opacities. Management of pulmonary contusions is supportive with control of pain, pulmonary toilet, lung expansion, and maintenance of adequate ventilation/oxygenation of the patient.

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21. An obese 37-year-old man is brought to the emergency department 30 minutes after being involved in a motor vehicle collision. He was the restrained front-seat passenger. His pulse is 90/min, respirations are 24/min, and blood pressure is 110/70 mm Hg. Ecchymoses are visible over the midabdomen from the lap belt. A nasogastric tube is inserted. An x-ray of the chest shows an obscured left hemidiaphragm with the tip of the nasogastric tube in the lower left side of the chest. Which of the following is the most likely diagnosis?

A) Diaphragmatic rupture
B) Esophageal rupture
C) Pancreatic injury
D) Pulmonary contusion
E) Ruptured spleen

Correct Answer: A.

Traumatic diaphragmatic rupture can occur after blunt trauma that causes a sudden increase in intra-abdominal pressure and leads to rupture of the diaphragm. An opening in the diaphragm can lead to the herniation of abdominal contents into the thorax, and often presents with chest pain, shortness of breath, and bowel sounds within the expected lung fields. It most commonly occurs in the left hemithorax and may be visualized as intestinal loops or other abdominal organs in the thorax on x-ray. In this patient, the presence of the nasogastric tube in the lower left side of the chest raises suspicion for diaphragmatic rupture. Management includes surgical exploration and repair of the ruptured diaphragm.

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

An esophageal rupture (Choice B) permits translocation of gastrointestinal contents such as food, stomach acid, and bacteria into the mediastinum, which if untreated, can lead to mediastinitis. Mediastinitis can present with chest pain, fever, and moribund appearance; the examination may disclose crepitus over the chest wall or neck, and a crunching sound may be heard on auscultation.

Pancreatic injury (Choice C) can present with epigastric pain, nausea, and vomiting, and if severe, persistent hypotension. It would not explain the presence of the nasogastric tube in the lower left side of the chest.

Pulmonary contusion (Choice D) may occur after blunt or penetrating trauma to the chest. It often underlies the region of trauma to the chest wall and results from damage to capillaries with associated leakage of intravascular and extravascular fluid into the pulmonary interstitium and alveolar airspaces, respectively. On chest x-rays, pulmonary contusions appear as interstitial infiltrates and/or patchy alveolar opacities.

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C) Pancreatic injury
D) Pulmonary contusion
E) Ruptured spleen

Correct Answer: A.

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

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Splenic rupture (Choice E) can cause large amounts of blood to leak into the peritoneal and/or retroperitoneal spaces, which can result in hemodynamic instability characterized by tachycardia and, if severe, hypotension. Patients with splenic injuries may have left upper quadrant tenderness, peritonitis from blood products irritating the peritoneum, or referred pain to the left shoulder secondary to diaphragmatic irritation.

Educational Objective: In blunt trauma, diaphragm rupture can occur due to a sudden increase in intra-abdominal pressure. A traumatic diaphragmatic hernia can lead to the presence of abdominal contents within the thorax, and presents with chest pain, shortness of breath, and bowel sounds within the expected lung fields.

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22. A 47-year-old man is admitted to the hospital for evaluation of a 7-day history of fever and diffuse mild abdominal pain. During the past 2 months, he has noticed increased abdominal girth. He has a long-standing history of alcoholism. His temperature is 38.5°C (101.3°F), pulse is 105/min, respirations are 16/min, and blood pressure is 135/82 mm Hg. Examination shows poor inspiratory effort. Heart sounds are normal. The abdomen is distended with mild tenderness throughout all quadrants and shifting dullness. Bowel sounds are decreased. Rectal examination shows no abnormalities. Paracentesis is performed. Laboratory studies show:

Serum	
Protein, total	5.2 g/dL
Albumin	3.4 g/dL
Globulin	1.8 g/dL
Peritoneal fluid	
Leukocyte count	3600/mm^3
Segmented neutrophils	68%
Monocytes	18%
Protein, total	1.1 g/dL
Albumin	0.7 g/dL

Which of the following is the most likely diagnosis?

A) Alcoholic hepatitis
B) Carcinomatosis
C) Enteric perforation
D) Peritoneal tuberculosis
E) Spontaneous bacterial peritonitis

Correct Answer: E.

Spontaneous bacterial peritonitis (SBP) is the most likely diagnosis in this patient with a history of alcohol use disorder, fever, abdominal pain, and ascitic fluid containing numerous neutrophils. SBP refers to the development of a peritoneal infection in patients with ascites that is not caused by instrumentation or introduction of bacteria into the peritoneum from an alternative source. This patient most likely has cirrhosis from chronic alcohol use. SBP is a common complication in patients with cirrhosis and ascites, regardless of the etiology. Portal hypertension (PH) leads to reduced intestinal motility with bacterial stasis and overgrowth in addition to impaired gastrointestinal immunity. PH also causes gut wall edema;

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

Alcoholic hepatitis (Choice A) classically presents with fever, jaundice, and tender hepatomegaly in a patient with active alcohol use. An increase in aspartate aminotransferase and alanine aminotransferase in a ratio of greater than 2:1 is also typical, but this diagnosis should only be made after SBP and other sources of fever have been excluded.

Carcinomatosis (Choice B) refers to metastatic disease involving the peritoneum and is frequently encountered in certain gynecologic cancers, such as ovarian cancer, or in primary peritoneal mesothelioma. Ascites formation occurs as a result of lymphatic obstruction, and tumor cells are often present in the ascitic fluid. This patient's presentation is more consistent with SBP.

Enteric perforation (Choice C) would be expected to lead to severe sepsis and clinical examination findings of peritonitis. Mild tenderness and shifting dullness are more consistent

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Spontaneous bacterial peritonitis (SBP) is the most likely diagnosis in this patient with a history of alcohol use disorder, fever, abdominal pain, and ascitic fluid containing numerous neutrophils. SBP refers to the development of a peritoneal infection in patients with ascites that is not caused by instrumentation or introduction of bacteria into the peritoneum from an alternative source. This patient most likely has cirrhosis from chronic alcohol use. SBP is a common complication in patients with cirrhosis and ascites, regardless of the etiology. Portal hypertension (PH) leads to reduced intestinal motility with bacterial stasis and overgrowth in addition to impaired gastrointestinal immunity. PH also causes gut wall edema; this confluence of factors can predispose to translocation of bacteria from the gut lumen into the bloodstream or across the wall into the peritoneal cavity. These pathogens can seed the peritoneal cavity, which, in patients with ascites, provides a perfect growth-medium for bacteria. Symptoms can include fever, hepatic encephalopathy, abdominal pain, and signs and symptoms of sepsis. The risk is higher in patients with lower serum albumin concentrations and in those who have experienced prior episodes of SBP. Diagnosis is made by diagnostic paracentesis that show an absolute neutrophil count of at least 250 cells/mm^3, which is present in this case. Gram stain is not sensitive for the diagnosis, but common pathogens include enteric flora, *Escherichia coli, Streptococcus spp*, and *Klebsiella pneumoniae*. Treatment is with antibiotics, usually a third-generation cephalosporin, followed by prophylaxis with ciprofloxacin or trimethoprim-sulfamethoxazole.

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Carcinomatosis (Choice B) refers to metastatic disease involving the peritoneum and is frequently encountered in certain gynecologic cancers, such as ovarian cancer, or in primary peritoneal mesothelioma. Ascites formation occurs as a result of lymphatic obstruction, and tumor cells are often present in the ascitic fluid. This patient's presentation is more consistent with SBP.

Enteric perforation (Choice C) would be expected to lead to severe sepsis and clinical examination findings of peritonitis. Mild tenderness and shifting dullness are more consistent with SBP as opposed to peritonitis from perforation.

Peritoneal tuberculosis (Choice D) occurs as a complication of miliary tuberculosis and causes ascites with a lymphocytic predominance. This patient's ascites with neutrophil predominance is more consistent with SBP.

Educational Objective: SBP is diagnosed in patients presenting with abdominal pain and ascites with an absolute neutrophil count of at least 250 cells/mm^3 in the absence of other causes of peritonitis, such as bowel perforation. It commonly causes fever, encephalopathy, and abdominal pain. Treatment is with antibiotics directed against the likely pathogen, and most patients are subsequently placed on antibiotic prophylaxis.

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23. A 27-year-old man comes to the physician because of a 6-month history of intermittent abdominal pain and a decreased energy level. The first episode of abdominal pain occurred after he ate a large meal. He then had an urgent need to move his bowels and passed watery stool containing bright red blood. At first, subsequent episodes occurred once or twice weekly and only involved abdominal pain. Four weeks ago, he started to have daily pain associated with bloody, watery stools. He has no history of serious illness and takes no medications. He visited Mexico 1 year ago. He is sexually active with one male partner, and they do not use condoms consistently. He appears pale and tired. He is 191 cm (6 ft 3 in) tall and weighs 83 kg (183 lb); BMI is 23 kg/m^2. His temperature is 36.9°C (98.4°F), pulse is 85/min, respirations are 18/min, and blood pressure is 115/70 mm Hg. The abdomen is scaphoid with mild, diffuse tenderness. No masses are palpated. Laboratory studies show:

Hemoglobin	9.3 g/dL
Hematocrit	29%
Leukocyte count	7800/mm^3
Platelet count	310,000/mm^3
Serum	
Antineutrophil cytoplasmic antibody	positive
Saccharomyces cerevisiae antibody	negative

Flexible sigmoidoscopy shows pseudopolyps and inflamed, friable mucosa. Which of the following is the most likely diagnosis?

A) Amebic dysentery
B) Crohn disease
C) Cytomegalovirus proctitis
D) Ulcerative colitis
E) *Yersinia* enterocolitis

Correct Answer: D.

Ulcerative colitis (UC) is the most likely diagnosis in this young patient with chronic abdominal pain, weight loss, hematochezia, and colonoscopy showing friable mucosa and pseudopolyps. UC is a chronic inflammatory condition within the spectrum of inflammatory bowel disease that results in inflammation and ulcers of the colonic mucosa, typically beginning with the rectum and advancing proximally. Symptoms range in severity from mild to severe and may include chronic abdominal pain, weight loss, bloody diarrhea, abdominal bloating, and tenesmus. Colonoscopy is the gold standard for diagnosis and demonstrates inflamed mucosa and ulcerations, sometimes in association with inflammatory pseudopolyps, extending in a continuous fashion proximally from the rectum. The presence of antineutrophil cytoplasmic antibodies (ANCA) and a negative test for antibodies to

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

Amebic dysentery (Choice A) is usually caused by *Entamoeba histolytica* and presents with subacute onset of bloody diarrhea and abdominal pain. Stool polymerase chain reaction, microscopy, or antigen testing can all be used to make the diagnosis. Colonoscopy showing continuous ulceration starting at the rectum in association with a positive ANCA would be an unusual presentation.

Crohn disease (Choice B) involving the colon is sometimes difficult to distinguish from UC, but patients with Crohn disease usually demonstrate transmural inflammation, involvement of the small bowel, and may also have perianal fistulous disease. A positive ANCA and negative *S. cerevisiae* antibody test are atypical for Crohn disease.

Cytomegalovirus proctitis (Choice C) is an opportunistic infection commonly occurring in immunocompromised patients in the setting of solid-organ or allogeneic stem cell transplantation, severe ulcerative colitis, or AIDS. It presents with abdominal pain, fever, weight loss, and watery or bloody diarrhea.

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E) *Yersinia* enterocolitis

Correct Answer: D.

Ulcerative colitis (UC) is the most likely diagnosis in this young patient with chronic abdominal pain, weight loss, hematochezia, and colonoscopy showing friable mucosa and pseudopolyps. UC is a chronic inflammatory condition within the spectrum of inflammatory bowel disease that results in inflammation and ulcers of the colonic mucosa, typically beginning with the rectum and advancing proximally. Symptoms range in severity from mild to severe and may include chronic abdominal pain, weight loss, bloody diarrhea, abdominal bloating, and tenesmus. Colonoscopy is the gold standard for diagnosis and demonstrates inflamed mucosa and ulcerations, sometimes in association with inflammatory pseudopolyps, extending in a continuous fashion proximally from the rectum. The presence of antineutrophil cytoplasmic antibodies (ANCA) and a negative test for antibodies to *Saccharomyces cerevisiae* strongly argues for a diagnosis of UC instead of Crohn disease. Treatment depends upon the severity of symptoms and the extent of disease. Mild disease involving only the rectum can often be managed solely with the use of 5-aminosalicylic acid (5-ASA) enemas while extensive disease usually requires oral 5-ASA medications or immunomodulating agents, steroids, or biologics.

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Yersinia enterocolitis (Choice E) is typically acute or subacute, and presents with abdominal pain, fever, and diarrhea. While dysentery (bloody diarrhea) does occur, this is more common in children than adults. This patient's chronic presentation in conjunction with colonoscopy and laboratory findings are inconsistent with this diagnosis.

Educational Objective: Ulcerative colitis is a chronic inflammatory condition within the spectrum of inflammatory bowel disease that results in inflammation and ulcers of the colonic mucosa, typically beginning with the rectum and advancing proximally. Symptoms include chronic abdominal pain, weight loss, bloody diarrhea, abdominal bloating, and tenesmus. A positive ANCA and negative *S. cerevisiae* antibody can help distinguish UC from Crohn disease.

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24. A 55-year-old woman has had vague pain in the left lower quadrant of the abdomen for 4 months and foul-smelling urine for 2 weeks. She appears thin. There is mild tenderness in the left lower quadrant of the abdomen. Rectal examination shows tenderness with no masses. Hematocrit is 29%. Urinalysis shows 50–100 WBC/hpf and 4+ bacteria. Urine culture grows greater than 100,000 colonies/mL of mixed fecal flora. Test of the stool for occult blood is positive. Which of the following is the most likely underlying diagnosis?

A) Amebiasis
B) Colon cancer
C) Familial polyposis
D) Intussusception
E) Ulcerative colitis

Correct Answer: B.

Colon cancer is the most likely cause of this patient's foul-smelling urine growing fecal bacteria and positive test for occult blood in the stool. Colon cancer is the third most common cancer in adults and most often presents after the age of 50 years, although patients with hereditary disorders or a positive family history of colon cancer frequently develop cancer at a younger age. Colorectal cancer is one of the few malignancies for which routine screening using colonoscopy can meaningfully change outcomes, as lesions that are detected early are often curable, while patients who present with symptoms referable either to the primary tumor or to metastatic disease have a far worse prognosis. In the case of this patient, the presence of fecal flora in the urine suggests a colovesical or other gastrointestinal-urinary fistula, which likely developed following erosion of a primary colonic mass into the bladder. The concomitant presence of a positive fecal occult blood stool test lends further evidence to the presence of a colonic mass, while her thin appearance, the duration of her symptoms, and a hematocrit of 29% suggest that the tumor has been present for at least 4 months and likely much longer. The next step in her evaluation should include a CT scan of the abdomen and pelvis with contrast and a colonoscopy. Treatment is largely determined by the extent of disease.

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

Amebiasis (Choice A) is usually caused by *Entamoeba histolytica* and presents with subacute onset of bloody diarrhea and abdominal pain. Stool polymerase chain reaction, microscopy, or antigen testing can all be used to make the diagnosis. This patient's presentation is not consistent with this diagnosis.

Familial polyposis (Choice C) is a genetic syndrome that causes colon cancer in almost 100% of patients if a colectomy is not performed prophylactically. Patients usually present in their 30s or 40s and frequently have a family history of colon cancer. This patient's colon cancer is more likely sporadic given her age and lack of family history.

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E) Ulcerative colitis

Correct Answer: B.

Colon cancer is the most likely cause of this patient's foul-smelling urine growing fecal bacteria and positive test for occult blood in the stool. Colon cancer is the third most common cancer in adults and most often presents after the age of 50 years, although patients with hereditary disorders or a positive family history of colon cancer frequently develop cancer at a younger age. Colorectal cancer is one of the few malignancies for which routine screening using colonoscopy can meaningfully change outcomes, as lesions that are detected early are often curable, while patients who present with symptoms referable either to the primary tumor or to metastatic disease have a far worse prognosis. In the case of this patient, the presence of fecal flora in the urine suggests a colovesical or other gastrointestinal-urinary fistula, which likely developed following erosion of a primary colonic mass into the bladder. The concomitant presence of a positive fecal occult blood stool test lends further evidence to the presence of a colonic mass, while her thin appearance, the duration of her symptoms, and a hematocrit of 29% suggest that the tumor has been present for at least 4 months and likely much longer. The next step in her evaluation should include a CT scan of the abdomen and pelvis with contrast and a colonoscopy. Treatment is largely determined by the extent of disease.

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

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Intussusception (Choice D) refers to a process by which one part of the bowel telescopes into an adjacent part of the bowel leading to bowel obstruction. In adults, this is most often secondary to the presence of a mass, which acts as the lead point. Symptoms of bowel obstruction include abdominal pain, nausea, and vomiting.

Ulcerative colitis (Choice E) is a chronic inflammatory condition within the spectrum of inflammatory bowel disease that results in inflammation and ulcers of the colonic mucosa, typically beginning with the rectum and advancing proximally. Symptoms include chronic abdominal pain, weight loss, bloody diarrhea, abdominal bloating, and tenesmus. The presence of a colovesical fistula would be atypical.

Educational Objective: Colon cancer is the third leading cause of cancer in the United States. Cancer may be detected in asymptomatic patients during routine screening or may be found late in the disease course when complications become apparent. The presence of fecal flora in the urine should alert the clinician to the possibility of a colovesical fistula. In patients without a prior history of surgery or fistulizing Crohn disease that might predispose to this complication, colon cancer is a likely culprit.

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25. A 68-year-old man has had an enlarging lump under his tongue over the past 3 months. The lesion is now ulcerated and somewhat painful. He quit smoking cigarettes 10 years ago. There is a mass adjacent to the inferior dental arch extending to the inferior surface of the tongue. Submental lymph nodes are palpable, but there is no neck adenopathy. Which of the following is the most appropriate next step in diagnosis?

A) Panoramic x-ray of the jaw
B) Barium swallow
C) Biopsy of the mass
D) Biopsy of the lymph nodes
E) Wide excision of the mass with radical neck dissection

Correct Answer: C.

Oropharyngeal carcinoma is common and may occur in the oral cavity, pharynx, larynx, or nasal cavity. Squamous cell carcinoma is the most common type of oropharyngeal carcinoma and is strongly associated with tobacco use and infection with human papillomavirus (HPV). Patients may present with an oropharyngeal lump or nodule, non-healing ulcer, dysphagia, odynophagia, and weight loss. Establishing the diagnosis with a biopsy is essential to guiding further management. Staging can be aided by cervical sentinel lymph node biopsy and imaging with CT or MRI scanning. Early-stage disease may be managed successfully with surgical excision, although more advanced lesions usually require a combined approach with surgery, radiotherapy, and chemotherapy.

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

Panoramic x-ray of the jaw (Choice A) is not useful for characterizing soft tissue tumors of the oropharyngeal cavity. Bone involvement is rare in oropharyngeal carcinoma and usually only occurs with large or advanced lesions.

Barium swallow (Choice B) is not useful for the diagnosis of oropharyngeal carcinoma. Biopsy is the most important initial step.

Biopsy of the lymph nodes (Choice D) is useful for staging of oropharyngeal carcinoma but is not as useful for establishing the initial diagnosis. Biopsy of the primary, sublingual lesion should be performed prior to lymph node biopsy.

Wide excision of the mass with radical neck dissection (Choice E) involves removal of the primary lesion as well as involved cervical lymph nodes, internal jugular vein, sternocleidomastoid, spinal accessory nerve, and parotid and submandibular glands. This procedure reduces the risk of further metastatic spread and may be appropriate for

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E) Wide excision of the mass with radical neck dissection

Correct Answer: C.

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Wide excision of the mass with radical neck dissection (Choice E) involves removal of the primary lesion as well as involved cervical lymph nodes, internal jugular vein, sternocleidomastoid, spinal accessory nerve, and parotid and submandibular glands. This procedure reduces the risk of further metastatic spread and may be appropriate for certain patients with suspected or established metastasis to the cervical lymph nodes, which occurs commonly in oropharyngeal carcinoma. Initial biopsy is necessary prior to proceeding to radical neck dissection because of the significant morbidity and mortality associated with the procedure.

Educational Objective: Oropharyngeal carcinoma is common and may occur in the oral cavity, pharynx, larynx, or nasal cavity. Squamous cell carcinoma is the most common type of oropharyngeal carcinoma and is associated with tobacco use and infection with HPV. Patients may present with an oropharyngeal lump or nodule, non-healing ulcer, dysphagia, odynophagia, and weight loss. A biopsy of the suspected lesion is the first step in establishing diagnosis.

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26. A 67-year-old man remains intubated and mechanically ventilated 6 hours after admission to the hospital for hematemesis. He has alcoholic cirrhosis and was brought to the emergency department 6 hours after he vomited a copious amount of blood. He has received 4 units of packed red blood cells. His current temperature is 37.4°C (99.3°F), pulse is 105/min, and blood pressure is 130/75 mm Hg. Examination shows peripheral muscle wasting. Cardiopulmonary examination shows no abnormalities. The abdomen is moderately distended and nontender. There is no fluid wave. His hematocrit is 29%. Placement of a nasogastric tube yields dark blood. Which of the following is the most appropriate next step in management?

A) Radiolabeled erythrocyte scan
B) Mesenteric arteriography
C) Esophagogastroduodenoscopy
D) Placement of a Sengstaken-Blakemore tube
E) Surgical exploration of the abdomen

Correct Answer: C.

Cirrhosis can be complicated by portal hypertension, which often leads to the development of esophageal or gastric varices that may rupture and lead to massive, life-threatening hematemesis. Additionally, alcoholic gastritis independent of cirrhosis and portal hypertension is a common source of gastrointestinal bleeding. In cirrhosis, obliteration of the hepatic sinusoids through progressive fibrosis increases the resistance to blood flow through the liver, which is transmitted to the portal venous system causing portal hypertension. When engorged secondary to portal hypertension, esophageal veins can be visualized on esophagogastroduodenoscopy (EGD) as vertical dilations underneath the esophageal mucosa, representing dilated submucosal veins (termed 'varices'). Varices are usually treated endoscopically by band ligation, and patients with cirrhosis must be screened for them, as the risk of life-threatening upper gastrointestinal bleeding is high. The definitive emergent treatment for any source of upper gastrointestinal bleeding is EGD, as it permits both identification of (and sometimes biopsy of) the source (diagnostic) and intervention to control bleeding (therapeutic). This patient presents with hematemesis likely from a ruptured varix, gastritis, or similar upper gastrointestinal source.

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

Radiolabeled erythrocyte scan (Choice A) can be used in the diagnosis of gastrointestinal bleeding to evaluate for a site of bleeding that is occult or could not be visualized by endoscopy. In this case, the patient is likely experiencing upper gastrointestinal bleeding, which can be diagnosed with upper endoscopy.

Mesenteric arteriography (Choice B) would be helpful in cases of gastrointestinal bleeding in the small or lower bowel. While not as sensitive as a radiolabeled erythrocyte scan, it permits direct visualization of contrast extravasation at the site of bleeding, which allows for definitive intervention via coil embolization.

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E) Surgical exploration of the abdomen

Correct Answer: C.

Cirrhosis can be complicated by portal hypertension, which often leads to the development of esophageal or gastric varices that may rupture and lead to massive, life-threatening hematemesis. Additionally, alcoholic gastritis independent of cirrhosis and portal hypertension is a common source of gastrointestinal bleeding. In cirrhosis, obliteration of the hepatic sinusoids through progressive fibrosis increases the resistance to blood flow through the liver, which is transmitted to the portal venous system causing portal hypertension. When engorged secondary to portal hypertension, esophageal veins can be visualized on esophagogastroduodenoscopy (EGD) as vertical dilations underneath the esophageal mucosa, representing dilated submucosal veins (termed 'varices'). Varices are usually treated endoscopically by band ligation, and patients with cirrhosis must be screened for them, as the risk of life-threatening upper gastrointestinal bleeding is high. The definitive emergent treatment for any source of upper gastrointestinal bleeding is EGD, as it permits both identification of (and sometimes biopsy of) the source (diagnostic) and intervention to control bleeding (therapeutic). This patient presents with hematemesis likely from a ruptured varix, gastritis, or similar upper gastrointestinal source.

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

Radiolabeled erythrocyte scan (Choice A) can be used in the diagnosis of gastrointestinal bleeding to evaluate for a site of bleeding that is occult or could not be visualized by endoscopy. In this case, the patient is likely experiencing upper gastrointestinal bleeding, which can be diagnosed with upper endoscopy.

Mesenteric arteriography (Choice B) would be helpful in cases of gastrointestinal bleeding in the small or lower bowel. While not as sensitive as a radiolabeled erythrocyte scan, it permits direct visualization of contrast extravasation at the site of bleeding, which allows for definitive intervention via coil embolization.

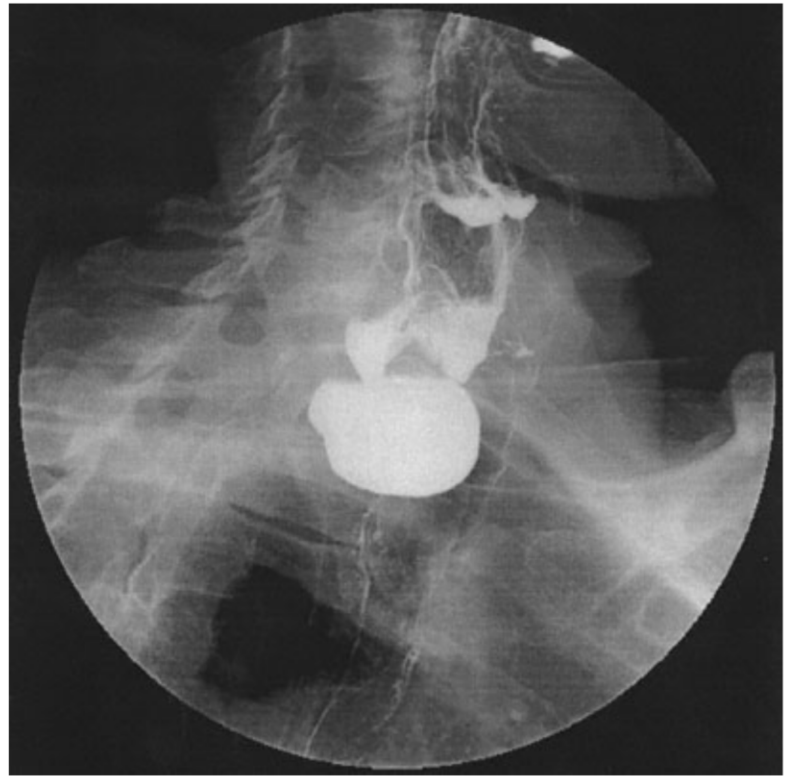
Placement of a Sengstaken-Blakemore tube (Choice D) would be indicated if this patient was continuing to have brisk hematemesis. A Sengstaken-Blakemore tube is a temporary measure to help tamponade active bleeding from esophageal varices. However, it would not take precedence over performing EGD, and it carries risk of esophageal or gastric perforation.

Surgical exploration of the abdomen (Choice E) would be indicated in cases of hemorrhagic shock related to a traumatic blunt or penetrating abdominal injury. The patient's bleeding is intraluminal, not peritoneal; thus, an exploratory laparotomy would not be indicated.

Educational Objective: Upper gastrointestinal bleeding, especially in the setting of cirrhosis and potential varices, may be life-threatening. Immediate management includes resuscitation with crystalloid and blood products, while definitive management includes esophagogastroduodenoscopy.

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27. A 77-year-old man comes to the physician because of a 4-month history of difficulty swallowing solids and liquids associated with gurgling in his throat. During this period, he has been waking during the night because of coughing and has had bad breath. He has not had any other symptoms. He underwent appendectomy at the age of 25 years and cholecystectomy for gallstones at the age of 50 years. He currently takes no medications. Examination today shows no abnormalities except for halitosis. A barium swallow is shown. Which of the following is the most appropriate next step in management?



A) Dietary counseling
B) Therapy with a proton pump inhibitor
C) Endoscopic dilatation of the esophagus
D) 24-Hour monitoring of esophageal pH
E) Diverticulectomy

Correct Answer: E.

A Zenker diverticulum occurs within the hypopharynx between the cricopharyngeus muscle and inferior pharyngeal constrictor muscle. The mechanism of formation includes an uncoordinated swallowing mechanism, which results in muscle spasms of the cricopharyngeus leading to pulsion diverticula as the wall of the hypopharynx and superior esophagus weakens. Symptoms include halitosis, regurgitation of undigested food, and dysphagia. Barium swallow reveals a posterior, midline outpouching above or at the level of the cricopharyngeus. Treatment includes surgical repair and resection (diverticulectomy), as well as dietary modifications to include soft or liquid foods.

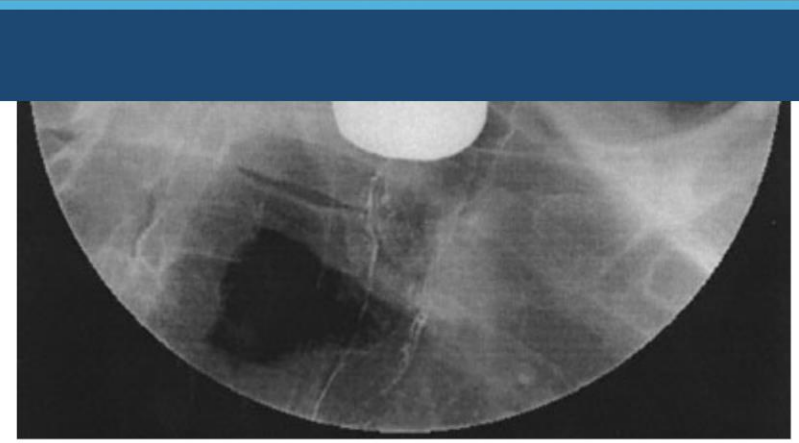
Incorrect Answers: A, B, C, and D.

Dietary counseling (Choice A) is a component of the management of Zenker diverticulum but is secondary to definitive treatment with diverticulectomy.

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D) 24-Hour monitoring of esophageal pH

E) Diverticulectomy



Correct Answer: E.

A Zenker diverticulum occurs within the hypopharynx between the cricopharyngeus muscle and inferior pharyngeal constrictor muscle. The mechanism of formation includes an uncoordinated swallowing mechanism, which results in muscle spasms of the cricopharyngeus leading to pulsion diverticula as the wall of the hypopharynx and superior esophagus weakens. Symptoms include halitosis, regurgitation of undigested food, and dysphagia. Barium swallow reveals a posterior, midline outpouching above or at the level of the cricopharyngeus. Treatment includes surgical repair and resection (diverticulectomy), as well as dietary modifications to include soft or liquid foods.

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

Dietary counseling (Choice A) is a component of the management of Zenker diverticulum but is secondary to definitive treatment with diverticulectomy.

Therapy with a proton pump inhibitor (Choice B) and 24-hour monitoring of esophageal pH (Choice D) are useful for the treatment and diagnosis, respectively, of gastroesophageal reflux disease (GERD). While GERD may present with nocturnal regurgitation of gastric contents and halitosis, it does not lead to esophageal dilatations or diverticulae on barium swallow.

Endoscopic dilatation of the esophagus (Choice C) is useful for the treatment of achalasia and strictures. Dysphagia, halitosis, and regurgitation of undigested food may be present, but these conditions can be distinguished by dilatation of the distal esophagus on barium swallow or an area of narrowing, respectively.

Educational Objective: A Zenker diverticulum occurs between the cricopharyngeus and inferior pharyngeal constrictor muscles because of incoordination of contraction between the muscles. Treatment includes surgical repair and resection (diverticulectomy), as well as dietary modifications to include soft or liquid foods.

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28. A 16-month-old boy is brought to the emergency department by his parents after they noticed a small amount of bright red blood in his diaper 2 hours ago. The boy awakened twice overnight screaming as if in pain, and the parents first saw the blood after the second awakening. The patient ate well and was playing normally prior to going to bed. Ten days ago, he had an upper respiratory tract infection which resolved without treatment. On arrival, the child is sleeping and is difficult to arouse. Vital signs are within normal limits. Palpation of the abdomen discloses mild tenderness and a mobile, 4 × 3-cm mass. There is no distention, rebound, or guarding. Bowel sounds are normoactive. A small amount of blood and mucus is noted in the patient's diaper. The remainder of the examination shows no abnormalities. An abdominal x-ray series shows a nonspecific gas pattern. Which of the following is the most appropriate next step in diagnosis?

A) Air enema with ultrasonography
B) CT scan of the abdomen
C) Laparotomy
D) MRI of the abdomen
E) Upper gastrointestinal series with small bowel follow-through

Correct Answer: A.

Intussusception refers to the telescoping of a portion of the intestine into itself, most commonly at the ileocolic junction. Symptoms include severe, intermittent abdominal pain, emesis, and hematochezia. Young children may be observed drawing their legs up toward their abdomen during pain episodes, and physical examination may disclose a palpable abdominal mass, as in this patient. Intussusception can be idiopathic or occur at a lead point, such as an area of inflammation or Meckel diverticulum. The intussusception leads to venous congestion, which results in intestinal edema with subsequent ischemia and necrosis. Severe cases lead to intestinal perforation and peritonitis. It most commonly occurs in children less than 2 years of age and is often preceded by a viral infection. Diagnosis is typically made with ultrasonography, which can disclose a “target sign” at the point of intussusception. Ultrasonography can also be used in conjunction with an air enema as both a diagnostic and therapeutic procedure pair for intussusception that has not progressed to perforation.

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

CT scan of the abdomen (Choice B) is not the best option for management of this patient. A CT scan can identify the area of intussusception but exposes the child to large amounts of radiation and does not reduce the intussusception.

Laparotomy (Choice C) is not yet indicated in this patient. Laparotomy is a surgical intervention reserved for severe cases of intussusception that evolve to bowel necrosis, perforation, and peritonitis. Bowel perforation and peritonitis are surgical emergencies and often present with fever, tachycardia, hypotension, and severe abdominal pain with

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E) Upper gastrointestinal series with small bowel follow-through

Correct Answer: A.

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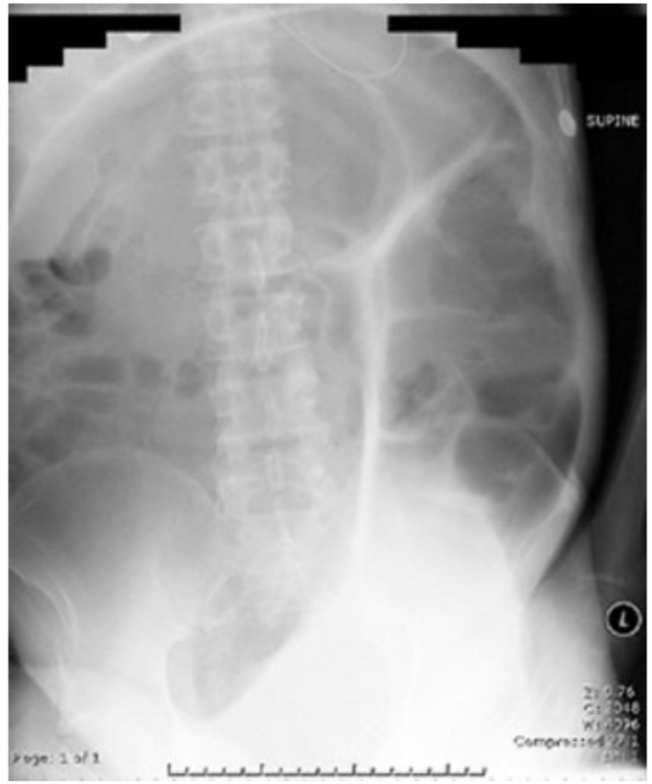
MRI of the abdomen (Choice D) is not first line in the diagnosis of intussusception. While it may be able to identify the pathology, it is time consuming and would delay appropriate treatment for this patient, increasing morbidity and mortality.

Upper gastrointestinal series with small bowel follow-through (Choice E) is not a diagnostic study used in the evaluation of possible intussusception. It is used to visualize abnormalities of the upper gastrointestinal tract, but the most common area of intussusception is at the ileocolic junction. Additionally, it may delay diagnosis for this patient, leading to an increased likelihood of complication.

Educational Objective: Intussusception occurs when a portion of the bowel telescopes into itself, most commonly at the ileocolic junction, leading to venous congestion, bowel edema, ischemia, bowel perforation, and peritonitis. It most frequently occurs in children under the age of two years and presents with severe, intermittent abdominal pain, emesis, and bloody diarrhea. Air enema with ultrasonography can be used to both diagnose and treat intussusception.

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29. A 76-year-old woman is brought to the emergency department because of a 3-day history of increasing abdominal distention and left lower quadrant tenderness. The patient has a history of Parkinson disease and chronic constipation. Medications are carbidopa-levodopa and docusate and enemas as needed. Vital signs are within normal limits. The abdomen is distended and moderately tender to palpation over the left lower quadrant; no peritoneal tenderness, masses, or hernias are noted. Results of laboratory studies show a leukocyte count of 18,000/mm^3. An abdominal x-ray is shown. Which of the following is the most likely diagnosis?



A) Colon cancer
B) Diverticular abscess
C) Rectal prolapse
D) Sigmoid volvulus
E) Small bowel obstruction

Correct Answer: D.

Sigmoid volvulus is the most likely cause of this patient's abdominal distention and pain. The x-ray of the abdomen discloses a grossly distended, air-filled colon with a dense, vertically oriented line that represents two walls of the colon in apposition (coffee-bean sign). Various other x-ray features, including the Frimann-Dahl sign, the presence of a distended colonic loop over the liver (liver overlap sign), and the absence of rectal gas, are useful in supporting this diagnosis. A sigmoid volvulus results from twisting of the sigmoid mesentery, which can lead to large bowel obstruction and perforation or intestinal necrosis if not appropriately treated. Patients commonly present with symptoms secondary to a large bowel obstruction, such as constipation, abdominal bloating, distention, nausea, and vomiting. 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.

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

Colon cancer (Choice A) may be detected in asymptomatic patients during routine colonoscopy, but the presentation of advanced colon cancer often includes symptoms such as hematochezia, abdominal pain, weight loss, and symptoms related to metastatic disease. This patient's abdominal x-ray discloses a volvulus, which is the most likely explanation for the presentation.

Diverticular abscess (Choice B) may develop as a result of diverticulitis, which is an infection of small outpouchings in the colon, known as diverticula. Symptoms frequently include abdominal pain, fever, and sometimes localized peritonitis. Diagnosis is made using abdominal a CT scan as x-rays are insensitive.

Rectal prolapse (Choice C) is a clinical diagnosis and appears as a mass protruding from the anus. In most cases, the mass is reducible. It does not present with diffuse abdominal pain, and the presence of a grossly distended colon on the abdominal x-ray does not support this diagnosis.

Small bowel obstruction (Choice E) presents with abdominal pain, nausea, and vomiting. X-ray with oral contrast may show a clear transition point beyond which radio-opaque contrast is not visualized, although CT scans are more sensitive. Most obstructions are caused by adhesions from prior surgeries, although tumors and hernias can also lead to obstruction.

Educational Objective: Sigmoid volvulus occurs when the sigmoid colon twists about its mesentery, resulting to large bowel obstruction. Symptoms include constipation, abdominal distention, and pain, along with nausea and vomiting. X-rays are used to confirm the diagnosis and often demonstrate a coffee-bean sign whereby the distended sigmoid colon takes on the appearance of a coffee bean. Treatment is with urgent decompression via sigmoidoscopy, although cases resulting in perforation require surgical management.

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30. A hospitalized 6-week-old girl with respiratory distress syndrome of the newborn has sudden episodes of apnea and temperature instability. Delivery was at 26 weeks' gestation. She has been exclusively fed with a cow milk-based formula. She appears pale and lethargic. Her temperature is 35.8°C (96.4°F), pulse is 160/min, respirations are 64/min, and blood pressure is 65/35 mm Hg. Capillary refill time is 6 seconds. Abdominal examination shows generalized distention and erythema around the umbilical stump. Bowel sounds are decreased. Laboratory studies show:

Leukocyte count	32,000/mm^3
Segmented neutrophils	10%
Bands	15%
Eosinophils	3%
Basophils	2%
Lymphocytes	70%
Platelet count	45,000/mm^3
Prothrombin time	30 sec (INR=2.5)
Partial thromboplastin time	70 sec



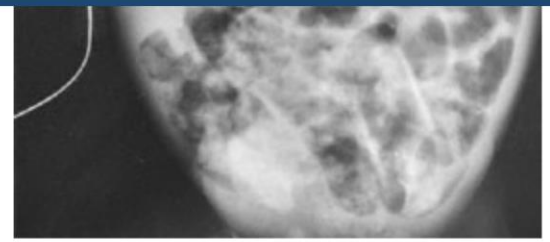
An abdominal x-ray is shown. Which of the following is the most likely diagnosis?

A) Congenital megacolon (Hirschsprung disease)
B) Hemorrhagic disease of the newborn
C) Malrotation
D) Necrotizing enterocolitis
E) Omphalitis

Correct Answer: D.

Necrotizing enterocolitis presents with decreased feeding tolerance, abdominal tenderness, distention, emesis, diarrhea, and hematochezia, most commonly in preterm infants, especially those with very low birth weights. If a feeding tube is present, gastric residual volumes may be high or there may be bilious drainage. In neonates, signs of severe systemic illness and shock include lethargy, temperature instability, apnea, and hypotension, some of which are seen in this patient. Laboratory evaluation will typically demonstrate leukocytosis, anemia, thrombocytopenia, and signs of disseminated intravascular coagulopathy with increased clotting times, as seen in this patient. It is caused by necrosis of the

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

Congenital megacolon (Hirschsprung disease) (Choice A) is caused by a failure of neural crest cells to migrate to the distal end of the colon during development. This leads to a functional distal bowel obstruction and most commonly presents in a newborn with failure to pass meconium within 48 hours. A common physical examination sign is the squirt sign, which is an elimination of gas and stool following a digital rectal examination. Hirschsprung disease would not cause pneumatosis intestinalis, as seen in this patient.

Hemorrhagic disease of the newborn (Choice B) is caused by a deficiency of vitamin K, a cofactor in the coagulation cascade, that leads to life-threatening bleeding. Newborns have an insufficient supply of vitamin K and are unable to generate it in their bowel early in life, as they have a sterile intestinal microbiome. To prevent this complication, newborns are given an intramuscular injection of vitamin K following birth. This patient does not have signs of bleeding, making necrotizing enterocolitis a more likely cause of her presentation.

Malrotation (Choice C) occurs due to a failure of the normal rotation of the intestines during fetal development. This results in a narrow-based mesentery, as well as abnormal bands of peritoneum that can obstruct the duodenum. A common presentation includes abdominal pain and distention, bilious emesis, hematochezia, peritonitis, and possible

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Malrotation (Choice C) occurs due to a failure of the normal rotation of the intestines during fetal development. This results in a narrow-based mesentery, as well as abnormal bands of peritoneum that can obstruct the duodenum. A common presentation includes abdominal pain and distention, bilious emesis, hematochezia, peritonitis, and possible hemodynamic instability, most often in children. It is less likely than necrotizing enterocolitis in this preterm infant with pneumatosis intestinalis.

Omphalitis (Choice E) is an infection of the umbilicus or its stump that is most commonly in newborns. It is associated with erythema, tenderness, and purulent discharge from the site. Treatment includes intravenous antibiotics. Omphalitis is less likely to be the cause of this patient's severe systemic illness than necrotizing enterocolitis.

Educational Objective: Necrotizing enterocolitis presents with decreased feeding tolerance, abdominal tenderness, distention, emesis, diarrhea, and hematochezia, most commonly in preterm infants. It is caused by necrosis of the intestinal mucosa, which allows the invasion of gas-forming bacteria into the bowel wall. This leads to pneumatosis intestinalis on abdominal x-ray, which is diagnostic of necrotizing enterocolitis.

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31. A 45-year-old man comes to the office because of a 1-month history of rectal bleeding that occurs with bowel movements. The patient states the blood is mixed with the stool. He does not report any pain with bowel movements and has not experienced any weight loss or fatigue. Medical history is unremarkable, and he takes no medications. There is no family history of cancer. Vital signs are within normal limits. Results of abdominal and digital rectal examination show no abnormalities. Test of the stool for occult blood is negative. Which of the following is the most appropriate next step in diagnosis?

A) Barium enema
B) Capsule endoscopy
C) Colonoscopy
D) CT colonography
E) Repeat test of stool for occult blood in 1 month

Correct Answer: C.

Isolated rectal bleeding can be caused by numerous etiologies. The more severe causes, such as malignancy and inflammatory bowel disease, benefit from early identification and treatment. Thus, the patient should next undergo colonoscopy. Colonoscopy allows for direct visualization of lesions, collection of biopsy samples, and immediate therapeutic interventions if needed. Patients with active hemorrhage or hemodynamic instability require hospitalization and urgent endoscopic evaluation, while chronic, intermittent bleeding can be evaluated in the outpatient setting.

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

Barium enema (Choice A) may be useful in the diagnosis of diverticulosis, colorectal cancer, or inflammatory bowel disease. However, colonoscopy is the preferred initial study, as it allows for more precise localization of lesions, collection of biopsy samples if indicated, and opportunity for immediate therapeutic intervention if needed.

Capsule endoscopy (Choice B) may be considered if a source of bleeding is not identified on colonoscopy or upper endoscopy, as limitations of endoscopy prevent assessment of most jejunal and proximal ileal lesions. Additional diagnostic studies after a colonoscopy depend on the clinical picture.

CT colonography (Choice D) is a newer, minimally invasive diagnostic study for evaluating the luminal aspect of the colon. While it has a role in screening for polyps and colorectal cancer in asymptomatic patients, a patient presenting with bleeding should undergo colonoscopy due to the need for biopsy and potential therapeutic intervention.

Repeat test of stool for occult blood in 1 month (Choice E) would not be appropriate. While most cases of isolated rectal bleeding are due to benign anal pathology (eg,

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C) Colonoscopy

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Repeat test of stool for occult blood in 1 month (Choice E) would not be appropriate. While most cases of isolated rectal bleeding are due to benign anal pathology (eg, hemorrhoids), the potential for life-threatening malignancy, polyps, or a lesion that could progress to massive hemorrhage still exists. Test of the stool for occult blood is neither sensitive nor specific enough to outweigh the benefit of colonoscopy in this patient.

Educational Objective: Initial management of lower gastrointestinal bleeding involves assessing for hemodynamic stability and triaging to the appropriate clinical setting for further evaluation. The preferred initial diagnostic study is a colonoscopy, as it provides the best evaluation of lesions with the ability to perform additional diagnostic or therapeutic interventions at the time of the study.

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32. A 47-year-old homeless woman with alcoholism is brought to the emergency department after vomiting dark maroon fluid three times during the past 6 hours. Temperature is 37.0°C (98.6°F), pulse is 130/min, respirations are 24/min, and blood pressure is 80/40 mm Hg. There is dark, crusted vomitus around her mouth, and scleral icterus. Abdominal examination shows ascites. Mental status examination shows short-term memory loss; she is oriented to person and place but not to time. Test of the stool for occult blood is positive. Laboratory studies show:

Hemoglobin	7 g/dL
Leukocyte count	12,000/mm^3
Serum	
Total bilirubin	5 mg/dL
Direct	3.5 mg/dL

Administration of fluids is begun. Upper endoscopy shows esophageal varices with evidence of recent bleeding; no other abnormalities are noted. Which of the following is the most appropriate next step in management?

A) Intravenous administration of ADH (vasopressin)
B) Operative creation of a transjugular intrahepatic portosystemic shunt
C) Placement of a Sengstaken-Blakemore tube
D) Placement of a transjugular portosystemic stent
E) Variceal banding

Correct Answer: E.

Variceal bleeding is a major cause of mortality in patients with cirrhosis, as patients can suffer large volume hemorrhage in a short period of time. In addition to volume resuscitation, transfusion of blood products, and airway protection, emergent upper esophagogastroduodenoscopy (EGD) is required to achieve hemostasis. Endoscopic interventions are the definitive treatment for active variceal hemorrhage. The two most common methods are variceal banding (also called variceal ligation) and sclerotherapy. Banding involves placement of small elastic bands to ligate the bleeding vessel. Sclerotherapy involves injection of a sclerosing solution in the vicinity of the vessel. Risk factors for variceal bleeding include the varix size, anatomical appearance, coagulopathy, and severity of cirrhosis. Additionally, patients with variceal bleeding in the setting of cirrhosis have improved outcomes with administration of somatostatin analogues (octreotide), antibiotics, and proton pump inhibitors.

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

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Variceal bleeding is a major cause of mortality in patients with cirrhosis, as patients can suffer large volume hemorrhage in a short period of time. In addition to volume resuscitation, transfusion of blood products, and airway protection, emergent upper esophagogastroduodenoscopy (EGD) is required to achieve hemostasis. Endoscopic interventions are the definitive treatment for active variceal hemorrhage. The two most common methods are variceal banding (also called variceal ligation) and sclerotherapy. Banding involves placement of small elastic bands to ligate the bleeding vessel. Sclerotherapy involves injection of a sclerosing solution in the vicinity of the vessel. Risk factors for variceal bleeding include the varix size, anatomical appearance, coagulopathy, and severity of cirrhosis. Additionally, patients with variceal bleeding in the setting of cirrhosis have improved outcomes with administration of somatostatin analogues (octreotide), antibiotics, and proton pump inhibitors.

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

Intravenous administration of ADH (vasopressin) (Choice A) is a pharmacologic adjunct that can be employed to decrease portal venous pressure and reduce mortality from variceal bleeding. However, it does not replace direct endoscopic variceal banding, which is the definitive management strategy.

Operative creation of a transjugular intrahepatic portosystemic shunt (Choice B), also called a TIPS procedure, is used to reduce portal venous pressures by placing a low-resistance route from the portal system to the hepatic vein, bypassing the liver. In the setting of a variceal bleed, TIPS is reserved as a rescue therapy if endoscopic interventions fail or if there is recurrent bleeding. Extrahepatic placement of a transjugular portosystemic stent (Choice D) is not commonly performed.

Placement of a Sengstaken-Blakemore tube (Choice C), also called balloon tamponade, is reserved for temporary stabilization of patients with life-threatening bleeding until definitive treatment can be achieved. Balloon tamponade has a high complication and rebleeding rate and places the patient at risk of lethal esophageal rupture. It is generally reserved for use only in cases of failure of less morbid measures.

Educational Objective: Variceal bleeding is a major cause of mortality in patients with cirrhosis because of the risk for massive acute hemorrhage. Endoscopic management of bleeding varices, typically using variceal banding or variceal sclerotherapy, is the definitive treatment modality.

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33. A previously healthy 37-year-old woman comes to the physician 6 hours after the onset of severe abdominal pain, fever, and chills. She takes no medications. Her temperature is 38.6°C (101.5°F). Abdominal examination shows severe right upper quadrant and epigastric tenderness. Laboratory studies show:

Hemoglobin	13 g/dL
Hematocrit	39%
Leukocyte count	18,000/mm^3 with a left shift
Serum	
Total bilirubin	1.2 mg/dL
Alkaline phosphatase	69 U/L
AST	19 U/L
ALT	15 U/L
Amylase	115 U/L

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

A) Abdominal ultrasonography
B) Upper gastrointestinal series
C) Endoscopic retrograde cholangiopancreatography
D) CT scan of the abdomen
E) HIDA scan

Correct Answer: A.

Abdominal ultrasonography is the first-line diagnostic examination for the evaluation of potential acute cholecystitis. Acute cholecystitis occurs secondary to obstruction of the cystic duct from a gallstone, which results in subsequent inflammation of the gallbladder wall. It typically presents with fever, right upper quadrant abdominal pain, and tenderness to palpation, often in a patient with a history of gallstones. It is occasionally preceded by symptoms of biliary colic from cholelithiasis. Characteristic ultrasonography findings of acute cholecystitis include gallbladder wall thickening and hyperemia, pericholecystic fluid, the presence of gallstones, dilated biliary ducts, and a sonographic Murphy sign (pain with compression directly over the gallbladder). If ultrasonography findings are equivocal, a HIDA scan, a nuclear medicine scan that evaluates for patency of the cystic duct and biliary tree, can be performed. Treatment includes supportive therapy, intravenous fluids, intravenous antibiotics, and urgent cholecystectomy.

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E) HIDA scan

Correct Answer: A.

Abdominal ultrasonography is the first-line diagnostic examination for the evaluation of potential acute cholecystitis. Acute cholecystitis occurs secondary to obstruction of the cystic duct from a gallstone, which results in subsequent inflammation of the gallbladder wall. It typically presents with fever, right upper quadrant abdominal pain, and tenderness to palpation, often in a patient with a history of gallstones. It is occasionally preceded by symptoms of biliary colic from cholelithiasis. Characteristic ultrasonography findings of acute cholecystitis include gallbladder wall thickening and hyperemia, pericholecystic fluid, the presence of gallstones, dilated biliary ducts, and a sonographic Murphy sign (pain with compression directly over the gallbladder). If ultrasonography findings are equivocal, a HIDA scan, a nuclear medicine scan that evaluates for patency of the cystic duct and biliary tree, can be performed. Treatment includes supportive therapy, intravenous fluids, intravenous antibiotics, and urgent cholecystectomy.

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

Upper gastrointestinal (GI) series (Choice B) is a fluoroscopic examination utilized for evaluation of the upper GI tract to investigate diseases such as peptic ulcer disease, gastric or duodenal neoplasms, malrotation or malformation, and complications following upper GI surgery such as gastrectomy and Roux-en-Y gastric bypass. It is not helpful in evaluating the gallbladder or biliary tree.

Endoscopic retrograde cholangiopancreatography (ERCP) (Choice C) evaluates the anatomy and patency of the biliary tree through endoscopic canalization of the duodenal ampulla. ERCP is indicated in the evaluation of acute and chronic biliary pathology, where it serves both a diagnostic and therapeutic purpose, including in the management of acute cholangitis, choledocholithiasis, and primary sclerosing cholangitis.

CT scan of the abdomen (Choice D) is not a first-line diagnostic examination for the evaluation of acute cholecystitis. Ultrasonography is more sensitive and specific than a CT scan for the assessment of acute gallbladder pathology.

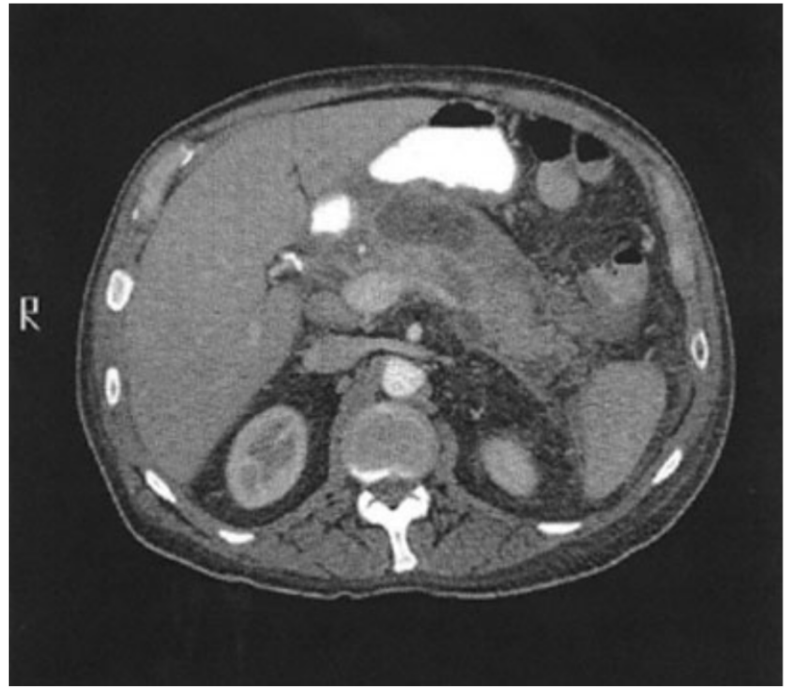
HIDA scan (Choice E) evaluates the patency of the hepatobiliary tree and gallbladder. It is useful in cases of suspected acute cholecystitis, choledocholithiasis, or biliary obstruction with indeterminate ultrasound findings. It is only indicated if results of ultrasonography are equivocal.

Educational Objective: Acute cholecystitis is caused by obstruction of the cystic duct by a gallstone, leading to inflammation of the gallbladder wall and infection if not treated promptly. Patients present with fever and right upper quadrant abdominal pain. Ultrasonography is the diagnostic imaging modality of choice as it is sensitive for the detection of acute cholecystitis.

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34. A 67-year-old man comes to the emergency department because of the gradual onset of severe epigastric pain radiating to his back during the past 10 hours. He also has had nausea and vomiting during this period. He has a long-standing history of alcoholism and had a 2-day weekend drinking binge that ended 3 days ago. He has no history of serious illness and takes no medications. On arrival, he appears restless and leans forward slightly to relieve his pain. His temperature is 38°C (100.4°F), pulse is 120/min, respirations are 18/min and shallow, and blood pressure is 110/60 mm Hg. Abdominal examination shows severe epigastric tenderness to palpation. Laboratory studies show:

Hematocrit	38%
Leukocyte count	12,000/mm^3
Serum	
Urea nitrogen	45 mg/dL
Creatinine	1.0 mg/dL
Amylase	3215 U/L



A CT scan of the abdomen is shown. In addition to intravenous administration of fluids, which of the following is the most appropriate next step in management?

A) Bowel rest
B) Endoscopic retrograde cholangiopancreatography
C) Percutaneous placement of a drain
D) Peritoneal dialysis
E) Surgical exploration of the abdomen

Correct Answer: A.

Acute pancreatitis typically presents with epigastric abdominal pain that radiates to the back, along with nausea and emesis, often in a patient with a history of gallstones, alcohol use disorder, trauma, hypertriglyceridemia, or hypercalcemia. Less common clinical manifestations are Grey-Turner sign, or bruising of the flanks, and Cullen sign, or bruising around the umbilicus. Acute pancreatitis can be complicated by necrosis, hemorrhage, abscess, or the formation of pseudocysts. Recurrent episodes of acute pancreatitis may lead to chronic pancreatitis and insufficiency of both the exocrine and endocrine pancreas. Increased serum lipase activity is commonly seen in acute pancreatitis. CT scan may

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D) Peritoneal dialysis

E) Surgical exploration of the abdomen

Correct Answer: A.

Acute pancreatitis typically presents with epigastric abdominal pain that radiates to the back, along with nausea and emesis, often in a patient with a history of gallstones, alcohol use disorder, trauma, hypertriglyceridemia, or hypercalcemia. Less common clinical manifestations are Grey-Turner sign, or bruising of the flanks, and Cullen sign, or bruising around the umbilicus. Acute pancreatitis can be complicated by necrosis, hemorrhage, abscess, or the formation of pseudocysts. Recurrent episodes of acute pancreatitis may lead to chronic pancreatitis and insufficiency of both the exocrine and endocrine pancreas. Increased serum lipase activity is commonly seen in acute pancreatitis. CT scan may demonstrate pancreatic parenchymal enlargement caused by inflammation and edema, liquefactive pancreatic necrosis, or retroperitoneal fat stranding. Treatment of uncomplicated acute pancreatitis is largely supportive and should include intravenous fluids, either 0.9% saline or lactated Ringer solution, bowel rest, and pain control. Surgical intervention may be required in cases of complications.

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

Endoscopic retrograde cholangiopancreatography, or ERCP, (Choice B) is recommended for patients with acute pancreatitis secondary to gallstones who display signs of ascending cholangitis or choledocholithiasis. Ascending cholangitis presents with fever and jaundice in addition to abdominal pain (Charcot triad) and possibly with shock and altered mental status (Reynolds pentad).

Percutaneous placement of a drain (Choice C) is useful for select patients with pseudocyst or abscess of the pancreas following acute pancreatitis, and in certain cases of pancreatic necrosis.

Peritoneal dialysis (Choice D) is not useful for the management of acute pancreatitis and is instead a management option in renal failure.

Surgical exploration of the abdomen (Choice E) is reserved for patients with acute pancreatitis complicated by extensive necrosis, pseudocyst formation, or abdominal compartment syndrome.

Educational Objective: Acute pancreatitis typically presents with epigastric abdominal pain that radiates to the back, along with nausea and emesis, often in a patient with a history of gallstones, alcoholism, trauma, hypertriglyceridemia, or hypercalcemia. Treatment of uncomplicated acute pancreatitis is largely supportive and should include intravenous fluids, bowel rest, and pain control.

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35. An 18-year-old man comes to the emergency department 48 hours after the sudden onset of right groin pain while lifting a heavy sofa. The pain has increased in intensity since onset, and he has vomited twice during the past hour. His temperature is 38.2°C (100.8°F), pulse is 100/min, respirations are 14/min, and blood pressure is 110/70 mm Hg. The right scrotum is edematous, slightly erythematous, acutely tender, and full. The abdomen is soft and mildly distended; bowel sounds are hyperactive. X-rays of the abdomen show a few air-fluid levels in the small bowel. Which of the following is the most appropriate next step in management?

A) Application of an ice pack and elevation of the scrotum
B) Observation and broad-spectrum antibiotic therapy
C) Ultrasonography of the scrotum
D) Needle aspiration of the scrotum
E) Immediate surgical exploration

Correct Answer: E.

An inguinal hernia occurs when a loop of bowel protrudes through the abdominal wall at and around the inguinal canal. Symptoms include a bulge in the groin or scrotum, with associated heaviness or a dull pain, often worsened with increased abdominal pressure during straining. Risk factors for their development include male sex, advanced age, chronic cough or constipation, smoking, and abdominal wall injury. Congenital hernias are caused by failure of the processus vaginalis to close, whereas acquired hernias are caused by a weakness in the abdominal musculature. Indirect inguinal hernias are the most common type of hernia, often congenital, and occur when the hernia protrudes through the internal ring of the inguinal canal. Direct inguinal hernias are more commonly acquired and occur within Hesselbach's triangle (bordered by the inguinal ligament, inferior epigastric vessels, and the rectus abdominis muscle). Incarceration occurs when the bowel loop is unable to reduce through the abdominal wall opening, which leads to edema and venous congestion of the bowel. Strangulation can occur with subsequent obstruction, ischemia, and necrosis, making both incarcerated and strangulated hernias a surgical emergency. Incarcerated and strangulated hernias present with tenderness to palpation, erythema, fever, and signs of bowel obstruction, such as emesis, abdominal distension, and air-fluid levels on x-ray. This patient presents with an erythematous, tender, full scrotum associated with fever and emesis after experiencing the abrupt onset of groin pain while straining, making a strangulated hernia the likely diagnosis. The patient should undergo immediate surgical exploration to reduce the hernia or remove the ischemic bowel.

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

Application of an ice pack and elevation of the scrotum (Choice A) are not the appropriate next steps in management of this patient. This patient has signs of systemic illness, with fever and tachycardia, likely due to bowel ischemia, and emergent surgical exploration should occur in order to reduce the hernia or remove the ischemic bowel.

Observation and broad-spectrum antibiotic therapy (Choice B) would significantly worsen the outcome of this patient. Delaying surgical intervention on an incarcerated or

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Correct Answer: E.

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

Application of an ice pack and elevation of the scrotum (Choice A) are not the appropriate next steps in management of this patient. This patient has signs of systemic illness, with fever and tachycardia, likely due to bowel ischemia, and emergent surgical exploration should occur in order to reduce the hernia or remove the ischemic bowel.

Observation and broad-spectrum antibiotic therapy (Choice B) would significantly worsen the outcome of this patient. Delaying surgical intervention on an incarcerated or strangulated bowel loop is likely to lead to bowel necrosis with consequent perforation and septic shock. This patient should undergo immediate surgical exploration.

Ultrasonography of the scrotum (Choice C) may confirm the diagnosis if loops of bowel are observed. However, ultrasonography would likely delay the time to operative intervention, which would increase the risk of morbidity and mortality in this patient. Ultrasonography would be appropriate in the investigation of suspected epididymoorchitis, among other genitourinary diagnoses.

Needle aspiration of the scrotum (Choice D) is incorrect. Needle aspiration may lead to perforation of the bowel loop, with subsequent leakage of bowel contents into the scrotum. Therefore, undergoing surgical exploration to determine the contents of the scrotum is the more appropriate next step in management of this patient.

Educational Objective: Incarcerated hernias, those unable to be reduced through the abdominal wall opening, lead to venous congestion and edema. Subsequent strangulation can occur with bowel obstruction, ischemia, and necrosis. Incarcerated and strangulated hernias are surgical emergencies.

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36. A hospitalized 77-year-old woman has had fever for the past 3 days. She underwent surgical repair of a perforated esophagus 4 weeks ago and has had a prolonged ileus. She received the diagnosis of pneumonia 16 days ago and has been intubated and mechanically ventilated since then. She is currently receiving broad-spectrum antibiotic therapy and parenteral nutrition. Her current temperature is 39°C (102.2°F). A central venous catheter is in place. Examination shows no rash. Heart sounds are normal. Blood cultures grow *Candida albicans*. In addition to intravenous fluconazole therapy, which of the following is the most appropriate next step in management?

A) Renal ultrasonography
B) CT scan of the abdomen
C) Intravenous acyclovir therapy
D) Intravenous amphotericin B therapy
E) Removal of the central venous catheter

Correct Answer: E.

Candida albicans is a fungal organism that most commonly causes oropharyngeal candidiasis, esophagitis, and vulvovaginitis. Candidemia, or the spread of *Candida* into the blood, is rare and often only seen in immunocompromised patients, with other risk factors including admission to the intensive care unit (ICU), central line access, and the administration of total parenteral nutrition. When present, candidemia often leads to severe sepsis with associated skin and ophthalmologic lesions. Other presenting symptoms are similar to those seen in bacteremia, such as fever, tachycardia, tachypnea, hypotension, and leukocytosis. Central line catheters are often placed for the administration of vasopressors in critically ill patients, as an alternative for venous access in patients with difficult to obtain peripheral access, and for the long-term administration of medications (eg, antibiotics or chemotherapy). Unfortunately, blood infections associated with central lines are a known complication often caused by skin flora such as *Staphylococcus spp.*, although they can also cause candidemia, as seen in this patient. Treatment of central-line associated candidemia requires removal of the central venous catheter, along with the administration of intravenous antifungal therapy.

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

Renal ultrasonography (Choice A) is not necessary in this patient. Renal ultrasonography can be used to evaluate for signs of pyelonephritis, nephrolithiasis, and renal infarction, among other diagnoses. Pyelonephritis is associated with dysuria, urinary urgency and frequency, flank pain, and signs of systemic illness. This patient is covered with broad-spectrum antibiotic therapy and pyelonephritis is unlikely to be caused by *Candida albicans*, making pyelonephritis less likely to be the source of infection in this patient.

CT scan of the abdomen (Choice B) may disclose intra-abdominal abscesses that can lead to persistent fevers in critically ill patients. However, intra-abdominal abscesses are more likely to be polymicrobial and anaerobic, rather than caused by *Candida albicans*.

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E) Removal of the central venous catheter

Correct Answer: E.

Candida albicans is a fungal organism that most commonly causes oropharyngeal candidiasis, esophagitis, and vulvovaginitis. Candidemia, or the spread of *Candida* into the blood, is rare and often only seen in immunocompromised patients, with other risk factors including admission to the intensive care unit (ICU), central line access, and the administration of total parenteral nutrition. When present, candidemia often leads to severe sepsis with associated skin and ophthalmologic lesions. Other presenting symptoms are similar to those seen in bacteremia, such as fever, tachycardia, tachypnea, hypotension, and leukocytosis. Central line catheters are often placed for the administration of vasopressors in critically ill patients, as an alternative for venous access in patients with difficult to obtain peripheral access, and for the long-term administration of medications (eg, antibiotics or chemotherapy). Unfortunately, blood infections associated with central lines are a known complication often caused by skin flora such as *Staphylococcus spp*., although they can also cause candidemia, as seen in this patient. Treatment of central-line associated candidemia requires removal of the central venous catheter, along with the administration of intravenous antifungal therapy.

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

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CT scan of the abdomen (Choice B) may disclose intra-abdominal abscesses that can lead to persistent fevers in critically ill patients. However, intra-abdominal abscesses are more likely to be polymicrobial and anaerobic, rather than caused by *Candida albicans*.

Intravenous acyclovir therapy (Choice C) is used to treat systemic viral infections, especially herpes simplex virus and varicella zoster virus. This patient's blood cultures are growing *Candida albicans*, which would not be treated with acyclovir therapy.

Intravenous amphotericin B therapy (Choice D) is used to treat systemic fungal infections. However, it is significantly nephrotoxic and is thus reserved for infections that are resistant to azole or echinocandin therapy. This patient is receiving azole therapy and adding an additional antifungal agent is unlikely to result in improved outcomes.

Educational Objective: Candidemia is a rare cause of systemic infection but can lead to significant morbidity and mortality when present. Risk factors include critical illness, immunocompromise, ICU admission, central venous catheter access, and total parenteral nutrition. Treatment includes the urgent administration of intravenous antifungal therapy, such as fluconazole or micafungin, and the removal of a central venous catheter, if present.

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37. Forty-eight hours after undergoing mechanical aortic valve replacement, a 67-year-old man develops oliguria. His postoperative course was complicated by emergency reexploration 18 hours after the valve replacement because of bleeding. At that time, he received 12 units of packed red blood cells and was hypotensive for 3 hours. Anticoagulant therapy has been withheld because of concern about bleeding. Currently, his temperature is 37.2°C (99°F), pulse is 102/min, and blood pressure is 110/68 mm Hg. Pulmonary capillary wedge pressure is 12 mm Hg (N=5–16). His serum urea nitrogen concentration is 56 mg/dL, and serum creatinine concentration is 3.1 mg/dL. On admission, his serum urea nitrogen concentration was 12 mg/dL, and serum creatinine concentration was 0.9 mg/dL. Which of the following is the most likely cause of the oliguria?

A) Acute transfusion reaction
B) Acute tubular necrosis
C) Hypoxia
D) Pulmonary edema
E) Renal artery embolus from the valve

Correct Answer: B.

Decreased urinary output following an episode of hypotension is consistent with a diagnosis of acute tubular necrosis (ATN). The cells of the proximal convoluted tubule, which are responsible for a large portion of ion resorption from glomerular filtrate, are highly metabolically active and are especially sensitive to ischemic injury. ATN progresses through an initial oliguric phase that may last for several weeks before recovery, followed by a subsequent polyuric phase. Ischemic ATN may occur secondary to any type of shock state. In this patient, hemorrhage leading to hypovolemic shock and hypotension impaired renal perfusion. Cardiogenic, obstructive, hypovolemic, and distributive shock etiologies can all result in renal hypoperfusion. ATN may also occur secondary to nephrotoxic exposures, such as heavy metals, antibiotics, and toxic alcohols. Urinalysis typically discloses muddy brown casts.

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

An acute febrile transfusion reaction (Choice A) (febrile, non-hemolytic transfusion reaction (FNHTR)) occurs due to the presence of preformed antibodies to donor leukocyte antigens and from cytokines in the plasma component of the transfused sample. FNHTR ranges from mild (mild fever, minimal additional symptoms) to severe (high fevers, rigors, myalgias, nausea). It would not cause acute kidney injury.

Hypoxia (Choice C) may be a cause of ATN; however, this patient has a known history of hypotension from hemorrhage, and no documented episodes of prolonged hypoxia.

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B) Acute tubular necrosis
C) Hypoxia
D) Pulmonary edema
E) Renal artery embolus from the valve

Correct Answer: B.

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Hypoxia (Choice C) may be a cause of ATN; however, this patient has a known history of hypotension from hemorrhage, and no documented episodes of prolonged hypoxia.

Pulmonary edema (Choice D) outside of cardiogenic shock or prolonged hypoxemia would not be direct cause of acute kidney injury. In addition, this patient's pulmonary capillary wedge pressure is normal, making cardiogenic pulmonary edema less likely.

Renal artery embolus from the valve (Choice E) could result in acute kidney injury, but it is less likely than acute tubular necrosis caused by hemorrhagic shock.

Educational Objective: Acute tubular necrosis frequently results from ischemic injury to the kidney and is characterized by damage to the proximal convoluted tubule. Sloughing of tubular cells results in the formation of muddy brown casts. Acute tubular necrosis presents initially with oliguria before progressing to polyuria when the cells regenerate.

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38. A 27-year-old man is brought to the emergency department by paramedics 30 minutes after his motorcycle collided with an automobile. He was ejected from the seat on impact. He was wearing a helmet. He has severe pelvic pain. His pulse is 100/min, respirations are 28/min, and blood pressure is 120/70 mm Hg. The lower abdomen is tender to palpation; there is no guarding or rebound. Examination of the pelvis shows severe tenderness on compression of the iliac crest. There is blood at the urethral meatus, and ecchymosis over the scrotum and perineum. On digital rectal examination, the prostate cannot be palpated. Which of the following is the most likely diagnosis?

A) Pelvic floor disruption
B) Rectal laceration
C) Ruptured bladder
D) Testicular torsion
E) Urethral transection

Correct Answer: E.

A motorcycle crash leading to pelvic pain, severe tenderness at the pelvis, and blood at the urethral meatus raises concern for a urethral injury. Urethral injuries are characterized by difficulty voiding, blood at the urethral meatus, perineal ecchymosis, and potential pelvic fracture. Straddle injuries can cause trauma to the anterior urethra, while pelvic fractures more often injure the posterior urethra. Depending on the location and severity of urethral injury, patients may require surgical repair or the placement of a urethral catheter to help promote healing and prevent complications of urinary extravasation, infection, fistula, or stricture.

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

Pelvic floor disruption (Choice A) can lead to stress urinary incontinence, which is triggered by an increase in intra-abdominal pressure (eg, lifting, sneezing, Valsalva). Risk factors include multiple vaginal deliveries, obesity, and prostate surgery.

Rectal laceration (Choice B) would be seen on rectal examination and would lead to rectal pain and rectal bleeding. It would not cause blood at the urethral meatus.

Ruptured bladder (Choice C) 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. Ruptures of the urinary bladder present with severe lower abdominopelvic pain and tenderness with associated anuria; blood may be noted at the urethral meatus on examination. This patient with suspected pelvic fracture is more likely suffering from urethral injury.

Testicular torsion (Choice D) occurs when the testicle rotates about itself within the scrotal sac. The twisting of the spermatic cord, which contains the gonadal artery, pampiniform

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Testicular torsion (Choice D) occurs when the testicle rotates about itself within the scrotal sac. The twisting of the spermatic cord, which contains the gonadal artery, pampiniform plexus, and gonadal vein, results in vascular congestion and potential cessation of venous or arterial flow. This can lead to testicular infarction if not promptly managed.

Educational Objective: Urethral injuries can occur from straddle injuries (anterior urethra) or pelvic fractures (posterior urethra). They typically present with anuria and blood at the urethral meatus.

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39. A 28-year-old woman comes to the office because of a 3-month history of a mass in the upper outer quadrant of her right breast. The patient says the mass fluctuates in size in relation to her menstrual cycle. She reports no pain or skin changes on or around the breast. Her family history is notable for a maternal aunt with a history of breast cancer diagnosed at age 45 years. Vital signs are within normal limits. Physical examination discloses a 1-cm mass that is mobile, well circumscribed, and nontender to palpation. No axillary or supraclavicular adenopathy is noted. The remainder of the examination discloses no abnormalities. Which of the following is the most appropriate next step in evaluation?

A) Mammography
B) MRI of the breast
C) Needle-localized biopsy
D) Ultrasonography of the breast
E) No further evaluation is indicated

Correct Answer: D.

Breast masses are common in women. While this patient likely has a benign tumor such as a fibroadenoma, a systematic approach to the evaluation of breast masses is pertinent. Evaluation of a new breast mass includes a thorough history and physical examination. Benign masses are commonly small, well-circumscribed, and mobile, whereas malignant lesions are more likely to be large, poorly defined, adherent to underlying tissue, and associated with skin or nipple changes. Further diagnostic evaluation of a breast mass depends on the patient's age, as well as the clinical concern for malignancy. In patients younger than age 30 years, such as this patient, ultrasonography is utilized as the initial imaging modality to further analyze a palpable breast mass. Cystic lesions are then observed or aspirated, benign-appearing solid lesions are observed, and malignant-appearing lesions are biopsied. For older patients, mammography is the initial imaging technique of choice.

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

Mammography (Choice A) can be used to diagnose breast masses or as a screening tool for breast cancer. It is often utilized as a first choice of imaging modality for the evaluation of palpable breast masses in women over the age of 30 years. Ultrasonography is the imaging modality of choice for women less than 30 years of age, as it is more likely to visualize the lesion in the dense breasts of young patients.

MRI of the breast (Choice B) is used in specific clinical scenarios, such as screening patients at high risk for breast malignancy and for the evaluation of masses concerning for malignancy that are poorly visualized by mammography or ultrasonography. This patient should first be assessed with ultrasonography, as it is likely to identify the mass, making MRI unnecessary.

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E) No further evaluation is indicated

Correct Answer: D.

Breast masses are common in women. While this patient likely has a benign tumor such as a fibroadenoma, a systematic approach to the evaluation of breast masses is pertinent. Evaluation of a new breast mass includes a thorough history and physical examination. Benign masses are commonly small, well-circumscribed, and mobile, whereas malignant lesions are more likely to be large, poorly defined, adherent to underlying tissue, and associated with skin or nipple changes. Further diagnostic evaluation of a breast mass depends on the patient's age, as well as the clinical concern for malignancy. In patients younger than age 30 years, such as this patient, ultrasonography is utilized as the initial imaging modality to further analyze a palpable breast mass. Cystic lesions are then observed or aspirated, benign-appearing solid lesions are observed, and malignant-appearing lesions are biopsied. For older patients, mammography is the initial imaging technique of choice.

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MRI of the breast (Choice B) is used in specific clinical scenarios, such as screening patients at high risk for breast malignancy and for the evaluation of masses concerning for malignancy that are poorly visualized by mammography or ultrasonography. This patient should first be assessed with ultrasonography, as it is likely to identify the mass, making MRI unnecessary.

Needle-localized biopsy (Choice C) is used to localize a breast mass that can be seen on imaging but not clinically felt prior to biopsy. The needles are placed under radiographic visualization and then the abnormality is surgically biopsied. This patient has a palpable breast mass, and ultrasonography should be done prior to biopsy.

No further evaluation is indicated (Choice E) is the incorrect answer. Failure to further evaluate this mass, although it is likely to be benign, could put the patient at risk for a delay in treatment if she were to have a breast malignancy. Further evaluation should be done with ultrasonography to determine if the mass warrants biopsy.

Educational Objective: Breast masses are common and should be carefully evaluated to rule out malignancy. Evaluation includes a thorough history and physical examination, imaging, and possible biopsy. Ultrasonography is recommended as the initial diagnostic test in patients under the age of 30 years, whereas mammography is recommended as the initial modality of choice in older patients.

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40. A 62-year-old woman has had a lump in her breast for 2 months. Her sister was diagnosed with breast cancer at the age of 65 years. Examination shows a 3 × 2 × 2-cm smooth mass in the upper outer quadrant of the right breast. There is no lymphadenopathy. Aspiration of the mass yields dark green fluid. No residual mass is palpable. Which of the following is the most likely diagnosis?

A) Breast abscess
B) Breast cancer
C) Breast cyst
D) Cystosarcoma phyllodes
E) Fat necrosis

Correct Answer: C.

Breast masses are common in women. Evaluation of a new breast mass includes a thorough history and physical examination. Benign masses are commonly small, well-circumscribed, and mobile, whereas malignant lesions are more likely to be large, poorly defined, adherent to underlying tissue, and associated with skin or nipple changes. Further diagnostic evaluation of a breast mass depends on the patient's age, as well as the clinical concern for malignancy. In patients younger than age 30 years, ultrasonography is utilized as the initial imaging modality to further analyze a palpable breast mass. For older patients, mammography is the initial imaging technique of choice. Cystic lesions are then observed or aspirated. A simple cyst that completely collapses after aspiration, as in this patient, requires no further management. As well, cysts with aspirate colors of clear, brown, and green are likely benign, while sanguinous aspirate should be sent to cytology because of the increased potential for malignancy.

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

Breast abscesses (Choice A) are infections of the breast tissue that occur primarily in breastfeeding women, but also occur in non-lactating women. They present as palpable, tender, fluctuant, erythematous masses, commonly associated with fever and purulent nipple discharge. This patient's mass is nontender and without erythema, making an abscess unlikely.

Breast cancer (Choice B) may be asymptomatic or present with a palpable, poorly defined, adherent breast mass associated with skin or nipple changes. However, most breast cancers are solid lesions and unlikely to resolve completely with aspiration.

Cystosarcoma phyllodes (Choice D) is a rare type of breast mass that is most often benign (~85%) but associated with rapid growth and occasional breast architecture changes. Cystosarcoma phyllodes is a solid mass and would not resolve with aspiration.

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C) Breast cyst
D) Cystosarcoma phyllodes
E) Fat necrosis

Correct Answer: C.

Breast masses are common in women. Evaluation of a new breast mass includes a thorough history and physical examination. Benign masses are commonly small, well-circumscribed, and mobile, whereas malignant lesions are more likely to be large, poorly defined, adherent to underlying tissue, and associated with skin or nipple changes. Further diagnostic evaluation of a breast mass depends on the patient's age, as well as the clinical concern for malignancy. In patients younger than age 30 years, ultrasonography is utilized as the initial imaging modality to further analyze a palpable breast mass. For older patients, mammography is the initial imaging technique of choice. Cystic lesions are then observed or aspirated. A simple cyst that completely collapses after aspiration, as in this patient, requires no further management. As well, cysts with aspirate colors of clear, brown, and green are likely benign, while sanguinous aspirate should be sent to cytology because of the increased potential for malignancy.

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

Breast abscesses (Choice A) are infections of the breast tissue that occur primarily in breastfeeding women, but also occur in non-lactating women. They present as palpable, tender, fluctuant, erythematous masses, commonly associated with fever and purulent nipple discharge. This patient's mass is nontender and without erythema, making an abscess unlikely.

Breast cancer (Choice B) may be asymptomatic or present with a palpable, poorly defined, adherent breast mass associated with skin or nipple changes. However, most breast cancers are solid lesions and unlikely to resolve completely with aspiration.

Cystosarcoma phyllodes (Choice D) is a rare type of breast mass that is most often benign (~85%) but associated with rapid growth and occasional breast architecture changes. Cystosarcoma phyllodes is a solid mass and would not resolve with aspiration.

Fat necrosis (Choice E) can cause breast masses in areas of blunt breast trauma or following a surgical procedure. While it can appear malignant on ultrasonography, it is a benign condition that demonstrates macroscopic fat on mammography. Aspiration would not cause it to resolve.

Educational Objective: Breast cysts are benign lesions that are frequently palpable, nontender, well-circumscribed, and mobile. They may be visualized on ultrasonography or mammography. If they completely collapse with aspiration, no further evaluation or management is necessary.

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41. A 68-year-old woman comes to the office for a routine examination. She has no history of serious illness and takes no medications. Vital signs are within normal limits. Examination of the breasts shows no abnormalities. Mammography of the right breast shows a 15-mm area of microcalcification; core needle biopsy results show intraductal breast carcinoma with two 1-mm areas of microinvasion. There are no abnormalities of the left breast. Which of the following is the most appropriate next step in management?

A) Excisional biopsy only
B) Excisional biopsy and radiation therapy
C) Lumpectomy and sentinel node biopsy
D) Mastectomy and axillary node dissection
E) Tamoxifen therapy and repeat mammography in 6 months

Correct Answer: C.

Breast cancer is the most common non-dermatologic malignancy in women. It commonly presents with an abnormal, potentially palpable, breast lump, with or without associated skin or nipple retraction, although it may be asymptomatic. Risk factors for the development of breast cancer include a family history of breast cancer, genetic mutation (eg, BRCA 1 or 2), early menarche, late menopause, nulliparity, obesity, exogenous estrogen use, and African American ethnicity. If screening mammography discloses a lesion concerning for malignancy, a percutaneous biopsy is warranted. This patient's biopsy was consistent with intraductal breast carcinoma. The most appropriate next step in management of this patient is a lumpectomy to remove the mass and a sentinel node biopsy to evaluate for metastases given the evidence of microinvasion on biopsy. This procedure would be both diagnostic and therapeutic and influence treatment strategies such as adjuvant systemic hormonal therapy, biologic therapy, or chemotherapy.

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

Excisional biopsy only (Choice A) would be useful in removing this patient's primary malignancy. An excisional biopsy is similar to a lumpectomy in that it involves surgical excision of the mass. However, this patient should also undergo sentinel lymph node biopsy to determine staging of her cancer given the evidence of microinvasion on biopsy.

Excisional biopsy and radiation therapy (Choice B) could treat this patient's breast carcinoma. However, radiation therapy may not be sufficient if her breast cancer has become metastatic to the lymph nodes or distant organs. Therefore, a sentinel node biopsy is pertinent to determine the extent of her disease.

Mastectomy and axillary node dissection (Choice D) would be inappropriate in this patient. Mastectomy with axillary node dissection is an aggressive and invasive surgical option for patients with locally advanced breast cancer. While this patient may require mastectomy in the future, lumpectomy will likely remove the entire mass with negative margins and

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E) Tamoxifen therapy and repeat mammography in 6 months

Correct Answer: C.

Breast cancer is the most common non-dermatologic malignancy in women. It commonly presents with an abnormal, potentially palpable, breast lump, with or without associated skin or nipple retraction, although it may be asymptomatic. Risk factors for the development of breast cancer include a family history of breast cancer, genetic mutation (eg, BRCA 1 or 2), early menarche, late menopause, nulliparity, obesity, exogenous estrogen use, and African American ethnicity. If screening mammography discloses a lesion concerning for malignancy, a percutaneous biopsy is warranted. This patient's biopsy was consistent with intraductal breast carcinoma. The most appropriate next step in management of this patient is a lumpectomy to remove the mass and a sentinel node biopsy to evaluate for metastases given the evidence of microinvasion on biopsy. This procedure would be both diagnostic and therapeutic and influence treatment strategies such as adjuvant systemic hormonal therapy, biologic therapy, or chemotherapy.

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

Excisional biopsy only (Choice A) would be useful in removing this patient's primary malignancy. An excisional biopsy is similar to a lumpectomy in that it involves surgical excision of the mass. However, this patient should also undergo sentinel lymph node biopsy to determine staging of her cancer given the evidence of microinvasion on biopsy.

Excisional biopsy and radiation therapy (Choice B) could treat this patient's breast carcinoma. However, radiation therapy may not be sufficient if her breast cancer has become metastatic to the lymph nodes or distant organs. Therefore, a sentinel node biopsy is pertinent to determine the extent of her disease.

Mastectomy and axillary node dissection (Choice D) would be inappropriate in this patient. Mastectomy with axillary node dissection is an aggressive and invasive surgical option for patients with locally advanced breast cancer. While this patient may require mastectomy in the future, lumpectomy will likely remove the entire mass with negative margins and should be pursued first.

Tamoxifen therapy and repeat mammography in 6 months (Choice E) is inappropriate. Tamoxifen is an estrogen receptor antagonist in the breast tissue. It is useful in the treatment of estrogen-receptor positive breast cancer. However, it is used in addition to surgical removal of the breast mass rather than as a standalone treatment and after confirming receptor positivity. Failing to remove the mass and repeating mammography in 6 months may allow the malignancy to metastasize.

Educational Objective: Breast cancer is the most common non-dermatologic malignancy in women. It may be discovered on screening mammography if asymptomatic and occult, or it may present with a palpable breast mass. Percutaneous biopsy is warranted for lesions concerning for malignancy. If positive for carcinoma, initial surgical intervention most commonly consists of lumpectomy to remove the mass with sentinel node biopsy to determine the extent of disease.

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42. An afebrile 8-year-old boy has the sudden onset of pain in the right testis. Examination shows a swollen, tender, slightly erythematous right scrotum. Leukocyte count is normal. Which of the following is the most appropriate next step in management?

A) Intravenous administration of antibiotics
B) Application of warm compresses and reevaluation in 12 hours
C) CT scan of the right scrotum
D) Percutaneous needle aspiration and drainage
E) Surgical exploration

Correct Answer: E.

Testicular torsion is caused by rotation of a testis around the spermatic cord. The twisting of the cord leads to compromise of the blood supply with resultant testicular edema, ischemia, and subsequent necrosis. It classically presents with acute testicular pain, tenderness to palpation, scrotal swelling, and a negative cremasteric reflex. The patient may develop nausea and emesis and/or lower abdominal pain prior to the onset of scrotal pain. Physical examination may show a high-riding testis that is oriented transversely with surrounding erythema. Testicular torsion is typically a clinical diagnosis, although ultrasonography can be used for further evaluation if the diagnosis is unclear. Ultrasonography will demonstrate diminished or absent blood flow to the testes. Testicular torsion is a surgical emergency and requires immediate urological evaluation when the diagnosis is suspected. Surgery will allow for detorsion of the testis and orchiopexy (testicular fixation) of both testes to prevent recurrent torsion.

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

Intravenous administration of antibiotics (Choice A) is not useful for the management of testicular torsion. Oral antibiotics are often used for the management of acute orchitis, which may also present with scrotal pain and swelling. However, the sudden onset of this patient's symptoms is more suggestive of testicular torsion.

Application of warm compresses and reevaluation in 12 hours (Choice B) is inappropriate. Delaying surgical intervention increases the risk of testicular infarction and necrosis, which necessitates orchiectomy and may result in infertility.

CT scan of the right scrotum (Choice C) is not useful for the evaluation of testicular torsion. Duplex ultrasonography remains the gold standard modality for evaluation of testicular structure and blood flow.

Percutaneous needle aspiration and drainage (Choice D) is not useful for the management of testicular torsion, although it may be used in select patients with testicular or

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C) CT scan of the right scrotum

D) Percutaneous needle aspiration and drainage

E) Surgical exploration

Correct Answer: E.

Testicular torsion is caused by rotation of a testis around the spermatic cord. The twisting of the cord leads to compromise of the blood supply with resultant testicular edema, ischemia, and subsequent necrosis. It classically presents with acute testicular pain, tenderness to palpation, scrotal swelling, and a negative cremasteric reflex. The patient may develop nausea and emesis and/or lower abdominal pain prior to the onset of scrotal pain. Physical examination may show a high-riding testis that is oriented transversely with surrounding erythema. Testicular torsion is typically a clinical diagnosis, although ultrasonography can be used for further evaluation if the diagnosis is unclear. Ultrasonography will demonstrate diminished or absent blood flow to the testes. Testicular torsion is a surgical emergency and requires immediate urological evaluation when the diagnosis is suspected. Surgery will allow for detorsion of the testis and orchiopexy (testicular fixation) of both testes to prevent recurrent torsion.

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

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CT scan of the right scrotum (Choice C) is not useful for the evaluation of testicular torsion. Duplex ultrasonography remains the gold standard modality for evaluation of testicular structure and blood flow.

Percutaneous needle aspiration and drainage (Choice D) is not useful for the management of testicular torsion, although it may be used in select patients with testicular or epididymal abscess, which is an uncommon complication of prolonged or severe epididymo-orchitis.

Educational Objective: Testicular torsion is caused by rotation of the testes around the spermatic cord and presents acutely with severe testicular pain, tenderness to palpation, scrotal swelling, and a negative cremasteric reflex. Management includes urgent surgical exploration for detorsion and orchiopexy.

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43. A 57-year-old woman comes to the physician because of a nonhealing lesion on her foot for 8 weeks. She has type 1 diabetes mellitus treated with insulin. Examination shows a nontender 2-cm plantar ulcer over the head of the first metatarsal. Dorsalis pedis pulses are normal bilaterally. Which of the following is the most likely underlying cause of the ulcer?

A) Arterial insufficiency
B) Chronic osteomyelitis
C) Lymphedema
D) Peripheral neuropathy
E) Venous stasis

Correct Answer: D.

In patients with diabetes mellitus, chronic hyperglycemia results in the deposition of advanced glycation end products in capillary endothelium. This leads to microvascular damage to capillaries throughout the body, including the vasa nervorum of the distal extremities, which impairs nerve function. While multiple mechanisms causing neuropathy are hypothesized, the end result when considering somatic sensory fibers is impaired sensory perception, a type of diabetic neuropathy. Diabetic neuropathy limits the healing response of the distal extremities and reduces the patient's awareness of injuries to the extremities, creating the conditions that result in the increased incidence of foot ulcerations in diabetic patients. Prolonged compression of soft tissues between bony prominences (such as the heads of the metatarsals) and hard surfaces (such as a shoe or floor) without offloading can result in breakdown of dermal tissue and ulceration. The feet and toenails should be carefully examined in all diabetic patients, especially those with known neuropathy, as these patients are at an increased risk for developing diabetic foot ulcers and infections. Poor foot and toenail hygiene may also lead to onychomycosis, overgrown nails, and bacterial overgrowth that can increase the likelihood of skin breakdown and development of serious infections. Patients should be counseled on regular foot care and examination.

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

Arterial insufficiency (Choice A) describes diminished flow of blood to the extremities secondary to atherosclerotic plaque. This most commonly affects the lower extremities. Patients typically present with claudication and potentially serious sequelae including ischemia and necrosis (gangrene) of the extremity. This patient's intact arterial pulses render this diagnosis less likely than neural injury secondary to diabetes mellitus.

Chronic osteomyelitis (Choice B) may occur because of lower extremity wounds, and if osteomyelitis remains untreated, impaired wound healing can result. However, the proximate cause of diabetic ulcers is the lack of appropriate sensory protective reflexes. The presence of osteomyelitis would be a result of this, even if such presence impaired future healing.

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E) Venous stasis

Correct Answer: D.

In patients with diabetes mellitus, chronic hyperglycemia results in the deposition of advanced glycation end products in capillary endothelium. This leads to microvascular damage to capillaries throughout the body, including the vasa nervorum of the distal extremities, which impairs nerve function. While multiple mechanisms causing neuropathy are hypothesized, the end result when considering somatic sensory fibers is impaired sensory perception, a type of diabetic neuropathy. Diabetic neuropathy limits the healing response of the distal extremities and reduces the patient's awareness of injuries to the extremities, creating the conditions that result in the increased incidence of foot ulcerations in diabetic patients. Prolonged compression of soft tissues between bony prominences (such as the heads of the metatarsals) and hard surfaces (such as a shoe or floor) without offloading can result in breakdown of dermal tissue and ulceration. The feet and toenails should be carefully examined in all diabetic patients, especially those with known neuropathy, as these patients are at an increased risk for developing diabetic foot ulcers and infections. Poor foot and toenail hygiene may also lead to onychomycosis, overgrown nails, and bacterial overgrowth that can increase the likelihood of skin breakdown and development of serious infections. Patients should be counseled on regular foot care and examination.

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

Arterial insufficiency (Choice A) describes diminished flow of blood to the extremities secondary to atherosclerotic plaque. This most commonly affects the lower extremities. Patients typically present with claudication and potentially serious sequelae including ischemia and necrosis (gangrene) of the extremity. This patient's intact arterial pulses render this diagnosis less likely than neural injury secondary to diabetes mellitus.

Chronic osteomyelitis (Choice B) may occur because of lower extremity wounds, and if osteomyelitis remains untreated, impaired wound healing can result. However, the proximate cause of diabetic ulcers is the lack of appropriate sensory protective reflexes. The presence of osteomyelitis would be a result of this, even if such presence impaired future healing.

Lymphedema (Choice C) occurs because of obstruction or excision of lymphatic channels, such as in cases of lymphoma, radiation, invasive parasitosis, or following a lymph node dissection. It is not a common cause of non-healing lower extremity ulceration.

Venous stasis (Choice E) may occur in patients with poor mobility and creates an increased risk of developing deep venous thrombosis (DVT). Non-healing lower extremity ulcers secondary to venous stasis are typically located about the ankle, rather than the plantar surface of the distal foot.

Educational Objective: Patients with diabetes mellitus can develop neuropathy, leading to impaired sensation and healing responses of the distal extremities and manifesting with ulceration and/or infection. Patients with diabetes mellitus should be counseled on the importance of routine foot inspection and foot care.

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44. A 62-year-old woman comes to the office because she has had a nontender lump on the left side of her neck for 3 months. She has had no hoarseness or difficulty swallowing. Examination shows a firm, palpable mass in the superior pole of the left thyroid lobe; on ultrasound, it is irregular and measures 2 × 1.2 cm. There is no neck adenopathy. Which of the following is the most appropriate next step in diagnosis?

A) CT scan of the neck
B) Direct laryngoscopy
C) Excisional biopsy
D) Fine-needle aspiration biopsy
E) ^{131}I thyroid scan
F) Technetium 99m scan

Correct Answer: D.

The initial evaluation for thyroid cancer includes a thorough history and a physical examination directed toward the identification of palpable thyroid nodules, regional lymphadenopathy, or vocal hoarseness. Following a physical examination, evaluation of the serum concentration of thyroid stimulating hormone (TSH) may disclose a normal or increased TSH concentration in the setting of a non-functioning nodule. Hyperfunctioning nodules are rarely malignant and may be detected via a decreased TSH level or with radioactive scintigraphy. Large, irregular, non-functional nodules, or nodules containing solid and cystic components, may require a biopsy with fine-needle aspiration. Excisional biopsy is best avoided given the rich vascular supply of the thyroid gland and its tendency to bleed. The Bethesda System for Reporting Thyroid Cytopathology can be used to characterize the malignant potential of a nodule and to guide further management, which may range from observation to thyroidectomy.

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

CT scan of the neck (Choice A) is unnecessary for localized thyroid nodules. Assessment of metastatic disease in the setting of confirmed thyroid cancer is best performed with an ^{131}I thyroid scan (Choice E), which can identify metastatic thyroid tissue.

Direct laryngoscopy (Choice B) is not useful for the evaluation of a thyroid nodule, as the affected tissue cannot be visualized through this approach. While thyroid cancer may lead to hoarseness in some patients, this is more commonly a result of palsy of the recurrent laryngeal nerve, rather than direct invasion of the larynx.

Excisional biopsy (Choice C) should be avoided when evaluating thyroid nodules. Thyroid tissue tends to bleed vigorously following excisional biopsy. Excisional biopsy also carries an increased risk of injury to the recurrent laryngeal nerve in comparison to fine-needle aspiration biopsy

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D) Fine-needle aspiration biopsy
E) ^{131}I thyroid scan
F) Technetium 99m scan

Correct Answer: D.

The initial evaluation for thyroid cancer includes a thorough history and a physical examination directed toward the identification of palpable thyroid nodules, regional lymphadenopathy, or vocal hoarseness. Following a physical examination, evaluation of the serum concentration of thyroid stimulating hormone (TSH) may disclose a normal or increased TSH concentration in the setting of a non-functioning nodule. Hyperfunctioning nodules are rarely malignant and may be detected via a decreased TSH level or with radioactive scintigraphy. Large, irregular, non-functional nodules, or nodules containing solid and cystic components, may require a biopsy with fine-needle aspiration. Excisional biopsy is best avoided given the rich vascular supply of the thyroid gland and its tendency to bleed. The Bethesda System for Reporting Thyroid Cytopathology can be used to characterize the malignant potential of a nodule and to guide further management, which may range from observation to thyroidectomy.

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

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Excisional biopsy (Choice C) should be avoided when evaluating thyroid nodules. Thyroid tissue tends to bleed vigorously following excisional biopsy. Excisional biopsy also carries an increased risk of injury to the recurrent laryngeal nerve in comparison to fine-needle aspiration biopsy.

Technetium 99m scan (Choice F) is useful for assessing the metabolic activity of thyroid tissue and can help to differentiate between conditions associated with abnormal thyroid uptake, such as Graves or Hashimoto disease. Fine-needle aspiration biopsy is a more appropriate next step in the evaluation of a localized, irregular thyroid nodule.

Educational Objective: Large, irregular, non-functional thyroid nodules, or thyroid nodules containing solid and cystic components, may require a biopsy with fine-needle aspiration. Excisional biopsy of thyroid nodules should be avoided given the tendency of thyroid tissue to bleed.

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45. A 29-year-old man with a 6-year history of end-stage renal disease undergoes uneventful renal transplantation. There is immediate diuresis of the kidney with urine output greater than 500 mL/h. Over the next several days, his serum creatinine concentration decreases to normal, and serum phosphorus concentration decreases to 1.5 mg/dL. The decrease in the serum phosphorus concentration is most likely because of which of the following?

A) Hypercalcemia
B) Hyperglycemia
C) Hyperkalemia
D) Hypernatremia
E) Hyperparathyroidism

Correct Answer: E.

Chronic kidney disease results in secondary and tertiary hyperparathyroidism caused by derangement of calcium and phosphate homeostasis. As the failing kidney is unable to regulate the level of blood calcium and phosphorus, parathyroid hormone (PTH) concentrations increase to promote increased serum calcium from gut, renal, and bone absorption, and to promote renal excretion of phosphorus. PTH levels remain persistently high in renal failure, and even after transplantation, the increased level can persist for several months or even a year or more. Following renal transplantation, the graft kidney will appropriately respond to PTH, which will result in reabsorption of calcium, and excretion of phosphorus. There are multiple proposed mechanisms beyond PTH to explain post-transplant hypophosphatemia, though PTH is postulated to play a primary role. Post-transplant, the kidney is also able to produce active Vitamin D, a function also lost in end-stage kidney disease. Vitamin D promotes gastrointestinal absorption of calcium and phosphorus, further contributing to restored serum levels of both, and affecting feedback on the parathyroid gland to produce PTH. The mechanism of electrolyte homeostasis following transplant is complex, though PTH and Vitamin D, among several other factors, play key roles.

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

Hypercalcemia (Choice A) is incorrect. Patients with end-stage kidney disease, such as this patient prior to renal transplant, are usually hypocalcemic, as the kidney cannot reabsorb calcium. While rebound hypercalcemia may occur following renal transplantation, underlying hyperparathyroidism is a more likely etiology for this patient's decrease in serum phosphorus concentration.

Hyperglycemia (Choice B) can lead to hypophosphatemia in the setting of diabetic ketoacidosis due to osmotic diuresis. While renal transplant may provoke ketoacidosis in patients with underlying diabetes mellitus, this complication is rare.

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E) Hyperparathyroidism

Correct Answer: E.

Chronic kidney disease results in secondary and tertiary hyperparathyroidism caused by derangement of calcium and phosphate homeostasis. As the failing kidney is unable to regulate the level of blood calcium and phosphorus, parathyroid hormone (PTH) concentrations increase to promote increased serum calcium from gut, renal, and bone absorption, and to promote renal excretion of phosphorus. PTH levels remain persistently high in renal failure, and even after transplantation, the increased level can persist for several months or even a year or more. Following renal transplantation, the graft kidney will appropriately respond to PTH, which will result in reabsorption of calcium, and excretion of phosphorus. There are multiple proposed mechanisms beyond PTH to explain post-transplant hypophosphatemia, though PTH is postulated to play a primary role. Post-transplant, the kidney is also able to produce active Vitamin D, a function also lost in end-stage kidney disease. Vitamin D promotes gastrointestinal absorption of calcium and phosphorus, further contributing to restored serum levels of both, and affecting feedback on the parathyroid gland to produce PTH. The mechanism of electrolyte homeostasis following transplant is complex, though PTH and Vitamin D, among several other factors, play key roles.

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

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Hyperglycemia (Choice B) can lead to hypophosphatemia in the setting of diabetic ketoacidosis due to osmotic diuresis. While renal transplant may provoke ketoacidosis in patients with underlying diabetes mellitus, this complication is rare.

Hyperkalemia (Choice C) commonly occurs in patients with end-stage kidney disease, particularly in the setting of oliguria, but is not typically associated with disturbances in phosphorus concentration.

Hypernatremia (Choice D) does not typically occur in patients following renal transplant and is an unlikely etiology of the decrease in this patient's serum phosphorus concentration.

Educational Objective: Secondary hyperparathyroidism typically presents in patients with end-stage kidney disease as increased parathyroid hormone secondary to hypocalcemia and hyperphosphatemia. Following renal transplantation, the restoration of PTH responsiveness results in renal phosphate wasting, though many mechanisms are postulated to explain post-transplant hypophosphatemia.

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46. A 57-year-old man is being evaluated in the hospital 1 day after undergoing open reduction and internal fixation of a right hip fracture. He sustained a myocardial infarction intraoperatively. Coronary artery angiography showed two occluded arteries; angioplasty and stenting were performed. He has hypertension, congestive heart failure, hypercholesterolemia, obesity, and major depressive disorder. Preoperative medications included metoprolol, atorvastatin, and fluoxetine; all have been continued since admission. Currently, he is intubated and receiving morphine intravenously every 4 hours and 5% dextrose in 0.9% saline (100 mL/h). His temperature is 37.2°C (99°F), pulse is 88/min, respirations are 16/min, and blood pressure is 130/92 mm Hg. Examination shows a well-healing surgical incision on the right hip. There is sacral edema. Preoperatively, his serum sodium concentration was 134 mEq/L. Laboratory studies today show:

Serum	
Na^+	128 mEq/L
K^+	4.1 mEq/L
Cl^-	90 mEq/L
HCO_3^-	23 mEq/L
Urea nitrogen	11 mg/dL
Glucose	100 mg/dL
Creatinine	1 mg/dL
Urine	
Sodium	40 mEq/L
Osmolality	500 mOsmol/kg H_2O

Which of the following is the most likely cause of this patient's hyponatremia?

A) Decreased total body sodium
B) Ectopic ADH (vasopressin) release
C) Excessive intravenous fluids
D) Increased hypothalamic ADH release
E) Shifting of water from the intracellular to extracellular compartment

Correct Answer: D.

Increased hypothalamic ADH release leading to increased free water resorption in the kidneys is the most likely cause of this patient's hyponatremia. Hyponatremia is often

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Urine	
Sodium	40 mEq/L
Osmolality	500 mOsmol/kg H_2O

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C) Excessive intravenous fluids
D) Increased hypothalamic ADH release
E) Shifting of water from the intracellular to extracellular compartment

Correct Answer: D.

Increased hypothalamic ADH release leading to increased free water resorption in the kidneys is the most likely cause of this patient's hyponatremia. Hyponatremia is often asymptomatic if chronic and slowly developing, although when acute, it is associated with central nervous system symptoms such as headache, nausea, vomiting, confusion, delirium, weakness, seizures, and coma. The cause of hyponatremia can usually be determined by assessing the patient's volume status in conjunction with their urine and serum sodium concentration and osmolality. In all instances of hypoosmolar hyponatremia, the appropriate physiologic response is to excrete dilute urine, which is reflected by a low urine osmolality (<100 mOsmol/kg H_2O). Urine osmolality that is substantially above this threshold suggests the presence of ADH, which can either be appropriate or inappropriate. Appropriate secretion of ADH occurs in patients who are hypovolemic or those with conditions such as cirrhosis, renal failure, or heart failure that leads to decreased effective circulating volume. In either case, increased ADH secretion results in the resorption of free water in the kidneys to maintain blood pressure even at the expense of serum tonicity. Rapid bedside assessment of the volume status can usually distinguish between hypovolemia and edematous states. Patients who are euvolemic and have normal blood pressure are more likely to have the syndrome of inappropriate ADH release (SIADH). As the name implies, release of ADH is inappropriate as these patients have a normal volume status. These patients also exhibit an increased urine sodium concentration, which is typically above 20 mEq/L. In rare instances, euvolemic patients with high urine osmolality and urine sodium concentration may have hypothyroidism or cortisol deficiency, but these are less common than SIADH and tend to present with other signs and symptoms.

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

Decreased total body sodium (Choice A) is incorrect. Hyponatremia is almost always caused by an excess of water rather than a deficiency in total body sodium apart from rare instances of truly inadequate dietary consumption of salt (eg, "tea and toast diet").

Ectopic ADH (vasopressin) release (Choice B) is most frequently encountered in the setting of small cell lung carcinoma. While increased secretion of ADH from a non-pituitary

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Increased hypothalamic ADH release leading to increased free water resorption in the kidneys is the most likely cause of this patient's hyponatremia. Hyponatremia is often asymptomatic if chronic and slowly developing, although when acute, it is associated with central nervous system symptoms such as headache, nausea, vomiting, confusion, delirium, weakness, seizures, and coma. The cause of hyponatremia can usually be determined by assessing the patient's volume status in conjunction with their urine and serum sodium concentration and osmolality. In all instances of hypoosmolar hyponatremia, the appropriate physiologic response is to excrete dilute urine, which is reflected by a low urine osmolality (<100 mOsmol/kg H_2O). Urine osmolality that is substantially above this threshold suggests the presence of ADH, which can either be appropriate or inappropriate. Appropriate secretion of ADH occurs in patients who are hypovolemic or those with conditions such as cirrhosis, renal failure, or heart failure that leads to decreased effective circulating volume. In either case, increased ADH secretion results in the resorption of free water in the kidneys to maintain blood pressure even at the expense of serum tonicity. Rapid bedside assessment of the volume status can usually distinguish between hypovolemia and edematous states. Patients who are euvolemic and have normal blood pressure are more likely to have the syndrome of inappropriate ADH release (SIADH). As the name implies, release of ADH is inappropriate as these patients have a normal volume status. These patients also exhibit an increased urine sodium concentration, which is typically above 20 mEq/L. In rare instances, euvolemic patients with high urine osmolality and urine sodium concentration may have hypothyroidism or cortisol deficiency, but these are less common than SIADH and tend to present with other signs and symptoms.

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Ectopic ADH (vasopressin) release (Choice B) is most frequently encountered in the setting of small cell lung carcinoma. While increased secretion of ADH from a non-pituitary source leads to the same physiologic consequences, this patient has no history of malignancy.

Excessive intravenous fluids (Choice C) can lead to hyponatremia, especially in patients with renal failure, heart failure, or cirrhosis, although this is more likely to happen with administration of hypotonic fluids such as 0.45% saline (1/2 NS) or 5% dextrose in water (D5W). This patient is receiving 0.9% saline, which is an isotonic fluid and not in excess of the appropriate maintenance rate.

Shifting of water from the intracellular to the extracellular compartment (Choice E) is incorrect as this would be the expected consequence of hypernatremia, not hyponatremia. In hyponatremia, the extracellular compartment is hypotonic in comparison to the intracellular environment, thus water shifts in the opposite direction.

Educational Objective: The cause of hyponatremia can often be determined by assessing a patient's volume status in conjunction with osmolality and sodium. The normal response to decreased effective circulating volume (eg, heart failure, hypovolemia) is to create maximally concentrated urine and increase urine sodium resorption, which results in a high urine osmolality and low urine sodium concentration. Euvolemic patients with high urine osmolality and urine sodium are more likely to have SIADH.

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47. A 37-year-old woman with stage IV breast cancer is admitted to the hospital because of lethargy and right thigh pain for the past 3 days. Her pulse is 100/min, respirations are 10/min, and blood pressure is 100/60 mm Hg. Physical examination shows dry mucous membranes. Mental status examination shows deficits in short-term memory. She is oriented to person but not to place or time. Her serum calcium concentration is 14.9 mg/dL. Administration of which of the following is the most appropriate next step in management?

A) Calcitonin
B) Furosemide
C) Methylprednisolone
D) Plicamycin
E) 0.9% Saline
F) Sodium biphosphate

Correct Answer: E.

Hypercalcemic crisis secondary to malignancy-associated hypercalcemia is the most likely cause of the patient's symptoms. Acute hypercalcemia can present with a broad spectrum of symptoms and can be life-threatening because of its effect on neuronal conduction, the cardiac action potential, kidney function, and volume status. It commonly presents with constipation, lethargy, weakness, and altered mental status. It can result in a short QT interval and nephrogenic diabetes insipidus, leading to significant dehydration. A potential cause of severe hypercalcemic crisis is malignancy-associated hypercalcemia, which can be secondary to the humoral secretion of parathyroid hormone-related peptide (eg, squamous carcinoma of the lung) or from direct invasion and lytic lesions of the bone from osseous metastases (eg, breast cancer). Treatment includes fluid resuscitation to prevent renal failure and promote calciuresis, reduction of intestinal absorption of calcium, inhibition of bony destruction, and, if necessary, renal replacement therapy with dialysis. Treatment therefore begins with the infusion of 0.9% saline to restore intravascular volume and dilute serum calcium, followed by the administration of osteoclast inhibitors such as bisphosphonates and possibly calcitonin if further intervention is required to reduce calcium levels. Loop diuretics may be appropriate after administration of intravenous fluids.

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

Calcitonin (Choice A) is a native hormone that inhibits osteoclast activity and reabsorption of calcium. It can be an adjunct treatment of hypercalcemia, but administration should not delay the first-line treatment of hypercalcemia, which is fluid resuscitation.

Furosemide (Choice B), a loop diuretic, acts at the renal tubule to promote fluid and electrolyte excretion, including calcium. It has a potential role in the management of hypercalcemia, but would be used following adequate volume resuscitation, not before

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Furosemide (Choice B), a loop diuretic, acts at the renal tubule to promote fluid and electrolyte excretion, including calcium. It has a potential role in the management of hypercalcemia, but would be used following adequate volume resuscitation, not before.

Methylprednisolone (Choice C) is used to reduce inflammation in rheumatologic (eg, systemic lupus erythematosus), neurologic (eg, multiple sclerosis), and infectious diseases (eg, hepatitis), as an adjunct in allergic and anaphylactic reactions, and in the management of bronchospasm and reactive airway disease (eg, asthma, emphysema). This patient presents with severe, symptomatic hypercalcemia for which fluids should be administered first; steroids may have an adjunct role in select cases, but not prior to administration of fluids.

Plicamycin (Choice D) inhibits RNA synthesis, serving as an anti-neoplastic antibiotic; it is rarely used for the treatment of hypercalcemia, but does have a known role in cases of severe malignancy-associated hypercalcemia. It is significantly toxic to the liver, kidney, and bone marrow, which greatly limits its use.

Sodium bisphosphate (Choice F) has an adjunct role in binding calcium within the gastrointestinal tract, preventing further absorption, but does not have a role in the abrupt lowering of serum calcium levels. Intravenous phosphate has been shown to bind calcium; however, the resulting insoluble calcium-phosphate product can deposit throughout tissues. This treatment may lead to additional organ dysfunction.

Educational Objective: Acute hypercalcemia can present with a broad spectrum of symptoms and can be life-threatening because of its effect on neuronal conduction, the cardiac action potential, kidney function, and volume status. First-line treatment requires fluid resuscitation with the administration of 0.9% saline to restore intravascular volume and dilute serum calcium.

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48. Five days after undergoing emergency surgery for a perforated appendix, a 67-year-old woman has abdominal pain and nausea; she has vomited twice during the past 30 minutes. She has coronary artery disease and sustained a myocardial infarction 2 years ago; she has been taking oral nitroglycerin since that time. She appears confused and agitated. Temperature is 38.8°C (101.8°F), pulse is 122/min, respirations are 23/min, and blood pressure is 88/50 mm Hg. There is no jugular venous distention. The lungs are clear to auscultation. Cardiac examination shows no abnormalities. There is mild distention of the abdomen with tenderness over the suprapubic area. Rectal examination shows mild tenderness on the right. This patient most likely has which of the following types of shock?

A) Cardiogenic
B) Extracardiac obstructive
C) Hypovolemic
D) Neurogenic
E) Septic

Correct Answer: E.

This patient has signs of sepsis, a systemic inflammatory syndrome that may occur in response to infection, including tachycardia, tachypnea, and fever, with a probable intra-abdominal source. Sepsis can be complicated by shock and multiorgan failure with a high mortality rate. Septic shock is characterized by vasoplegia (impaired response of the vasculature to vasoconstricting stimuli) with markedly decreased systemic vascular resistance (SVR), tachycardia, increased cardiac output, oliguria, and lactic acidosis. This reduction in SVR is secondary to cytokine-mediated endothelial and vessel wall smooth muscle dysfunction. The initial step in management of septic shock involves emergent antibiotics and fluid resuscitation with isotonic crystalloids, such as 0.9% saline.

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

Cardiogenic (Choice A) 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 increased pulmonary capillary wedge pressure if there is left-sided heart dysfunction, along with increased SVR.

Extracardiac obstructive (Choice B) shock can occur with pulmonary pathology such as pulmonary embolism or tension pneumothorax. In tension pneumothorax, obstruction of venous return results in jugular venous distention.

Hypovolemic (Choice C) shock occurs secondary to a significant reduction in intravascular volume, commonly related to hemorrhage or dehydration, which results in decreased

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C) Hypovolemic
D) Neurogenic
E) Septic

Correct Answer: E.

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Extracardiac obstructive (Choice B) shock can occur with pulmonary pathology such as pulmonary embolism or tension pneumothorax. In tension pneumothorax, obstruction of venous return results in jugular venous distention.

Hypovolemic (Choice C) shock occurs secondary to a significant reduction in intravascular volume, commonly related to hemorrhage or dehydration, which results in decreased stroke volume and cardiac output.

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, bradycardia, and arteriolar vasodilation.

Educational Objective: Sepsis is characterized by an inflammatory response to infection that in severe cases or septic shock presents with hypotension and decreased end-organ perfusion. Patients may demonstrate fever, tachycardia, tachypnea, hypotension, and examination or laboratory evidence of end-organ dysfunction.

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49. A comatose 44-year-old woman is brought to the emergency department 30 minutes after sustaining a severe head injury in a motor vehicle collision. Her temperature is 36.2°C (97.1°F), pulse is 98/min, and blood pressure is 110/70 mm Hg. She is intubated and mechanically ventilated. The pupils are midrange and fixed, and gag and ciliary reflexes are absent. She does not respond to painful stimuli, and there are no spontaneous respirations. She has a depressed frontal skull fracture, and there is blood in the nares and right auditory canal. The family agrees to organ donation but requests proof of brain death other than the physical findings. Which of the following is the most effective test to determine brain death?

A) Cerebral blood flow studies
B) CT scan of the head with contrast
C) Measurement of intracranial pressure
D) MRI of the brain
E) Skull series with tomography

Correct Answer: A.

Death is a challenging and common situation that physicians will encounter in practice. Though the exact nature of death remains an ongoing debate, the current generally accepted definitions in the medical field are irreversible cessation of circulatory and pulmonary function or irreversible cessation of all functions of the whole brain, which is referred to as brain death. The American Academy of Neurology (AAN) issues guidelines to aid clinicians, medical systems, and patients' families in accepting a declaration of brain death. The three primary criteria for adult brain death are: known cause of coma and exclusion of any potentially reversible factors, a neurologic examination that tests for brain stem reflexes and a central response to pain, and an apnea test which assesses whether the brain can drive respiratory functions in response to an increase in CO_2. If there is any remaining uncertainty, certain ancillary tests may be performed to demonstrate an absence of cerebral blood flow. The gold standard for cerebral blood flow studies is cerebral angiography; transcranial ultrasonography, CT or MR angiography, and radionuclide brain imaging can also be used.

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

The other choices, CT scan of the head with contrast (Choice B), measurement of intracranial pressure (Choice C), MRI of the brain (Choice D), and skull series with tomography (Choice E) do not provide direct information on brain function and are not accepted in making a declaration of brain death in the absence of cerebral blood flow studies. They may provide additional diagnostic or prognostic information in meeting the first criteria, which is determining an underlying etiology and excluding potentially reversible conditions.

Educational Objective: Brain death describes the irreversible cessation of whole brain functions. Guidelines issued by the American Academy of Neurology recommend assessing brain function with a focused neurologic examination and apnea test. Additional testing for the presence or absence of cerebral blood flow can aid in the decision-making process.

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50. An 18-year-old woman with ovarian germ cell cancer comes to the physician with her parents to discuss treatment options. Her condition has progressed despite chemotherapy, and the chemotherapy has caused multiple adverse effects. Her parents have researched a new experimental treatment protocol that would involve bone marrow transplantation but would only have a 5% 2-year survival likelihood. The daughter does not want to undergo transplantation because she says that she is ready to die. Her parents are distraught and want to do everything possible to improve her prognosis. Which of the following is the most appropriate next step in management?

A) Ask the hospital ethics committee if the transplant should be performed
B) Respect the wishes of the patient
C) Obtain a court order for psychiatric assessment to determine the patient's decision-making capacity
D) Proceed with the transplant at the parents' request

Correct Answer: B.

The four pillars of contemporary medical ethics are nonmaleficence (do no harm), beneficence (do good), respect for autonomy (allow the patient to choose freely, as they are able), and justice (fair access, distribution, and use of medical resources). The ethical principle that applies most strongly in this case is autonomy, the right of the patient to ultimately decide what treatments they do and do not receive. In respecting autonomy, it is implied that the patient has capacity to make rational, informed, and voluntary decisions with reason and understanding. Society recognizes that age is a factor in the ability to make a fully reasoned choice with understanding, and the age at which patients are considered to have full autonomy is determined by the legal system. Generally, patients that are 18 years of age or older are considered to have full autonomy in medical decision-making. In this case, the moral decision is to respect the wishes of the patient. Additionally, this course of action also respects the principles of nonmaleficence and beneficence, as the patient has already experienced several adverse effects from treatment, and the additional experimental treatment is not yet known to provide any significant benefit with comparable mortality rates.

Incorrect Answers: A, C, and D.

Ask the hospital ethics committee if the transplant should be performed (Choice A) is not necessary in this case, as there is no conflict between the different pillars of medical ethics or controversy over determining the patient's ability to make an informed, autonomous decision. Similarly, choosing to obtain a court order for psychiatric assessment to determine the patient's decision-making capacity (Choice C) is unnecessary in this situation.

Proceed with the transplant at the parents' request (Choice D) would not be appropriate as it would violate the autonomy of the patient. Input from family members and loved ones can be a major factor in helping a patient make an autonomous decision; however, the decision ultimately belongs to the patient.

Educational Objective: Contemporary medical ethics is guided by the principles of nonmaleficence, beneficence, autonomy, and justice. It is considered the moral duty of clinicians

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Educational Objective: Contemporary medical ethics is guided by the principles of nonmaleficence, beneficence, autonomy, and justice. It is considered the moral duty of clinicians to respect the autonomy of patients who have the capacity to make rational, informed, and voluntary decisions regarding their care.

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