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### QUESTION 1

A 17-year-old female is brought to the emergency department by her parents due to right foot pain. She denies recent trauma and has no history of major illnesses. She is physically active and walks for at least one hour daily. She says that she is doing well in high school and gets along well with her parents except that they keep telling her to eat more especially since her boyfriend broke up with her a year ago. Vitals reveal a weight 47.6 kg (105 lbs) and BMI of 16 kg/m<sup>2</sup>. The most likely diagnosis is

- A. conversion disorder
- B. depressive disorder
- C. gonococcal arthritis
- D. injured medial ankle tendon
- E. metatarsal fracture

**Answer: E**

#### **Explanation:**

This patient's low BMI and a year long history of poor eating habits are consistent with anorexia nervosa. Anorexic patients have an unreasonable fear of gaining weight and "feel fat" even when overweight and engage in prolonged physical activity in order to lose weight. This patient most likely started eating poorly after her breakup with her boyfriend. Metatarsal stress fractures are a complication of rigorous physical activity in patients with anorexia due to chronic malnourishment which results in low bone density. Other findings include amenorrhea, electrolyte disturbances, lanugo, anemia and coexisting depression. Psychotherapy and nutritional rehabilitation are first line treatments.

### QUESTION 2

A 65-year-old male who had a cholecystectomy at a local hospital experiences nausea and vomiting two days later. He is prescribed metoclopramide by the resident physician. Metoclopramide is contraindicated in patients with:

- A. coronary artery disease
- B. liver cirrhosis
- C. migraine headaches
- D. Parkinson disease
- E. urinary tract infections

**Answer: D**

#### **Explanation:**

This patient most likely has post-surgery gastroparesis. Metoclopramide is a D<sub>2</sub> receptor antagonist which increases intestinal motility, contractility and lower esophageal sphincter tone. It also promotes gastric emptying. Metoclopramide is commonly used to treat diabetic and post-surgical gastroparesis, gastroesophageal reflux disease and chemotherapy induced nausea and vomiting. Its side effects include parkinsonism, tardive dyskinesia, diarrhea, depression and restlessness. It is contraindicated in patients with Parkinson disease and small bowel obstruction.

### QUESTION 3

A 34-year-old female comes to the physician with nausea and abdominal pain. She indicates that the pain is epigastric, and it improves with food intake. She also reports recent weight gain. A urease breath test is obtained which is positive. This patient is most likely at an increased risk for developing

- A. bladder cancer

- B. brain abscesses
- C. gastric adenocarcinoma
- D. heart block
- E. myocarditis

**Answer: C**

**Explanation:**

This patient most likely has a duodenal ulcer caused by infection with *Helicobacter pylori*. *Helicobacter pylori* is a urease positive, catalase positive, oxidase positive, curved shaped gram-negative bacterium. It may colonize the antrum of the stomach and cause gastric ulcers or colonize the first part of the duodenum causing duodenal ulcers. Infection with *H. pylori* increases the risk for developing peptic ulcer disease, gastric adenocarcinomas and MALT lymphomas.

#### QUESTION 4

A 27-year-old male comes to the physician with skin lesions as shown in the exhibit. Physical examination reveals soft tissue crepitus and the smell of decomposing tissue. The most likely cause of these findings can also cause infection through

- A. ingestion
- B. fecal-oral transmission
- C. respiratory droplet inhalation
- D. sexual transmission
- E. skin to skin transmission

**Answer: A**

**Explanation:**

This patient's clinical findings are consistent with gas gangrene and myonecrosis caused by an infection with the gram-positive bacteria *Clostridium perfringens*.

The myonecrosis which causes gas gangrene heard as crepitus in the soft tissues is caused by the bacterium's alpha toxin which functions as a phospholipase.

The route of infection resulting in myonecrosis is infection of an open skin wound by the soil-borne anaerobic bacteria. The spores of *C. perfringens* can also survive in undercooked food and when ingested, cause food poisoning. To answer this question correctly, you first have to make the diagnosis, know the cause of the diagnosis, the other type of illness it causes and its route of infection.

#### QUESTION 5

An 18-month-old male is brought to the physician due to mental retardation and abdominal distention. Physical examination reveals enlargement of the liver and spleen. Fundoscopy reveals a cherry red spot on the macula. The most likely other finding in this patient is increased levels of

- A. ceramide trihexoside
- B. cerebroside sulfate
- C. galactocerebroside
- D. GM2 ganglioside
- E. sphingomyelin

**Answer: E**

**Explanation:**

This patient most likely has Niemann-Pick disease which is an autosomal recessive lysosomal storage disease caused by a deficiency of sphingomyelinase. It is more common in Ashkenazi Jews. Deficiency of sphingomyelinase leads to the accumulation of sphingomyelin, progressive

neurodegeneration, hepatosplenomegaly and lipid laden macrophages also called foam cells. Similar to Tay-Sachs disease, a "cherry-red" spot can be seen on the macula.

#### QUESTION 6

A 50-year-old male is brought to the emergency department due to an acute onset chest pain that radiates to his jaw. An ECG reveals ST segment elevation in leads II, III and a VF. He undergoes percutaneous coronary intervention with stenting without any complications. The patient is discharged from the hospital three days later with aspirin and clopidogrel. He returns to the emergency department eight weeks later due to recurrent chest pain which he describes as a sharp pain that worsens when he lies flat. The pain does not radiate or improve with nitroglycerin tablets. Vitals reveal a blood pressure of 135/87 mmHg, a heart rate of 84/min, a temperature of 38.0°C (100.5°F) and a respiratory rate of 12/min. Oxygen saturation is 98% on room air. Physical examination reveals a harsh three component extra heart sound heard best at the left lower sternal border. An ECG is obtained which reveals diffuse ST elevations. The most likely cause of the current findings is

- A. autoimmune pericarditis
- B. infective endocarditis
- C. papillary muscle rupture
- D. Prinzmetal angina
- E. stent thrombosis

**Answer: A**

#### Explanation:

This patient most likely has Dressler syndrome, which is an autoimmune post-myocardial infarction phenomenon resulting in fibrinous pericarditis. Fibrinous pericarditis presents with fever and positional chest pain, with patients generally preferring to remain upright and leaning forward. Physical examination findings include a loud three component pericardial friction rub heard on auscultation and ECG changes include diffuse ST segment elevations. Patients with autoimmune pericarditis typically present several weeks after an acute myocardial infarction.

#### QUESTION 7

A 60-year-old male with a past medical history of hyperlipidemia and hepatic dysfunction comes to the physician for a routine examination. He states that he has had difficulty initiating urination for the past seven months with an intermittent urine stream and urinary urgency. Vitals reveal a blood pressure of 150/90 mmHg, a heart rate of 65/min, a temperature of 37.0°C (98.6°F) and a respiratory rate of 12/min. Digital rectal examination reveals diffuse enlargement of the prostate. The most appropriate pharmacologic treatment for this patient is most likely a drug that:

- A. activates central alpha-2 receptors
- B. blocks alpha and beta receptors
- C. blocks muscarinic receptors
- D. inhibits 5-alpha reductase
- E. selectively blocks alpha-1 receptors

**Answer: E**

#### Explanation:

This patient has the clinical findings consistent with benign prostatic hyperplasia (BPH). He also seems to have hypertension. BPH usually presents with difficulty initiating urination, a decreased urinary stream, nocturia, high postvoid residual volume and urinary retention. High concentrations of alpha-1-adrenergic receptors are found in the smooth muscle of the bladder neck and stroma and capsule of the prostate. Stimulation of these receptors causes increased smooth muscle tone

and blockade of these receptors can reversibly relax these muscles, leading to decreased urinary symptoms. Terazosin and doxazosin are examples of alpha-1- adrenergic antagonists that act in vascular smooth muscle, producing relaxation and relief of urinary symptoms. They are indicated for the treatment of both BPH and hypertension (vascular smooth muscle).

#### QUESTION 8

A 3-year-old male is brought to the physician due to an enlarging abdominal mass. Physical examination reveals a mass in the left abdomen that does not cross the midline. Ophthalmic examination is unremarkable. Microscopic examination of a biopsy specimen from the abdomen reveals dense immature islands of epithelial cells, ribbons of spindle fibroblastic stromal cells and poorly formed tubular structures. The most likely diagnosis:

- A. embryonal rhabdomyosarcoma
- B. Ewing sarcoma
- C. Hodgkin disease
- D. neuroblastoma
- E. Wilms tumor

**Answer: E**

**Explanation:**

Wilms tumor is the most common renal malignancy of early childhood (ages 2-4) that can present as an abdominal mass with hypertension, nausea, hematuria, and intestinal obstruction. Histologically, it is a neoplasm of the embryonic renal tissue that consists of both neoplastic epithelia and a stromal component. It is associated with mutations of the tumor suppressor genes WT1 or WT2 on chromosome 11. A close differential diagnosis for this child is a neuroblastoma but it is an extrarenal tumor which crosses the midline. Wilms tumor may also be associated with several syndromes such as the aniridia, genitourinary malformations and mental/motor retardation syndrome (WAGR complex), Denys-Drash syndrome and Beckwith-Wiedemann syndrome.

#### QUESTION 9

A 45-year-old female comes to the physician because of headaches and palpitations. Vitals reveal a blood pressure of 190/140 mm Hg and a heart rate of 105/ min. A CT scan of the abdomen is obtained which reveals an adrenal mass. The hormones secreted by the adrenal mass are derived from:

- A. arginine
- B. glutamate
- C. glycine
- D. tryptophan
- E. tyrosine

**Answer: E**

**Explanation:**

This patient has an adrenal pheochromocytoma which is the most common adrenal medullary tumor in adults. It usually presents with episodic hypertension, headaches and palpitations. The tumor arises from the sympathetic chromaffin cells in the adrenal gland hence it secretes catecholamines such as epinephrine, norepinephrine and dopamine which are derived from tyrosine.

#### QUESTION 10

A 6-year-old male is brought to the physician due to a sore throat, fever and malaise. Physical examination reveals an erythematous tongue and a sandpaper-like body rash. This most likely sequelae of this infection includes all of these except

- A. hematuria
- B. joint pain
- C. muscular spasm
- D. myocarditis
- E. nodules under the skin

**Answer: C**

**Explanation:**

Group A Streptococcus pyogenes is a bacitracin sensitive beta-hemolytic gram-positive bacterium which can cause pyogenic, toxigenic and immunologic illnesses. This patient most likely has scarlet fever which presents with streptococcal pharyngitis, circumoral pallor and a sandpaper-like body rash. Streptococcal infections can be complicated with rheumatic fever or post streptococcal glomerulonephritis. Laboratory findings include the presence of anti-DNase B antibodies and elevated anti-streptolysin (ASO) titers. Antibodies to the M protein enhance host defenses but can also cause rheumatic fever due to molecular mimicry.

Prophylaxis with penicillin is indicated to prevent rheumatic fever. Rheumatic fever is characterized by myocarditis, migratory polyarthritides, erythema marginatum, Sydenham chorea and subcutaneous nodules. Acute post streptococcal glomerulonephritis presents with hematuria, periorbital edema and hypertension.

Muscular spasms are not features of rheumatic fever or post streptococcal glomerulonephritis.

#### QUESTION 11

A 2-year-old male is brought to the physician due to mental retardation. Physical examination reveals a single palmar crease, flat face and prominent epicanthal folds. The most likely cause of these findings is:

- A. heteroplasmy
- B. incomplete penetrance
- C. meiotic nondisjunction
- D. mosaicism
- E. Robertsonian translocation

**Answer: C**

**Explanation:**

This patient with a flat face, mental retardation, prominent epicanthal folds and a single palmar crease most likely has trisomy 21 also called Down syndrome. It is the most common cause of genetic intellectual disability. Other findings in patients with trisomy 21 include duodenal atresia, Hirschsprung disease, atrioventricular septal defects, Brushfield spots and early onset Alzheimer disease. The most common cause of Down syndrome is meiotic nondisjunction in older pregnant females. A few cases of Down syndrome are caused by unbalanced Robertsonian translocations mostly between chromosomes 14 and 21 and only 1% of cases are due to post-fertilization mitotic errors. Nondisjunction is the failure of homologous chromosomes or sister chromatids to separate properly during cell division. Meiotic nondisjunction is implicated in 95% of Down syndrome cases.

#### QUESTION 12

A group of research scientists are studying immunohistochemical stains used for detecting the different types of cell. The stain which is used to detect epithelial cells is:

- A. chromogranin
- B. cytokeratin
- C. desmin
- D. neurofilaments
- E. vimentin

**Answer: B**

**Explanation:**

Cytokeratin is a keratin-containing intermediate filament found in the intracytoplasmic cytoskeleton of epithelial tissue. In the cytoplasm, the keratin filaments form a complex network which extends from the surface of the nucleus to the cell membrane. The cytokeratin stain is used to detect epithelial cells and tumors.

### QUESTION 13

A 50-year-old male with AIDS develops a fever, headache and stiff neck. A sample of his cerebrospinal fluid reveals the presence of lymphocytes, glucose levels of 35 mg/dL and protein levels of 75 mg/dL. The test which would most likely confirm this patient's diagnosis is the:

- A. India ink test
- B. latex particle agglutination test
- C. molecular probe test
- D. polymerase chain reaction test
- E. Tzanck smear

**Answer: B**

**Explanation:**

This patient with AIDS most likely has meningitis caused by *Cryptococcus neoformans*, which is a heavily encapsulated yeast found in pigeon droppings and acquired through inhalation. The fungi can be highlighted with India ink and mucicarmine but latex particle agglutination testing is more specific. It detects the polysaccharide capsular antigens shed into the CSF. Cryptococcal meningitis is an opportunistic infection and treatment is with amphotericin B and flucytosine followed by fluconazole.

### QUESTION 14

A 30-year-old Caucasian male with HIV/AIDS develops right-sided weakness involving his right leg. A MRI of his brain reveals multiple ring enhancing lesions within the white matter in his left frontal lobe. The most likely source of this infection in the United States is

- A. Anopheles mosquito bite
- B. bird droppings
- C. cooling systems
- D. poorly cooked pork
- E. rodent droppings

**Answer: D**

**Explanation:**

This patient has AIDS which predisposes him to opportunistic infections such as toxoplasmosis. The classic presentation of the reactivation of toxoplasmosis in AIDS patients is the presence of brain abscesses which are seen as multiple ring enhancing lesions on a MRI. *Toxoplasma gondii* is a protozoan which infects humans who ingest the oocysts from cat feces or improperly cook lamb or pork. Although cats are the necessary definitive host, the most common source of

infection in the United States is poorly cooked pork. Immunocompromised hosts and fetuses are vulnerable to severe infection. In the fetus, toxoplasmosis causes extensive damage to the brain parenchyma and retina. Treatment is with sulfadiazine and pyrimethamine. In AIDS patients, the most frequent causes of ring enhancing lesions are primary brain lymphoma and toxoplasmosis.

#### QUESTION 15

A 30-year-old female is brought to the emergency department after being involved in a motor vehicle accident. She was not wearing a seatbelt and was ejected from her car seat upon collision with a tree. Physical examination reveals several lacerations on her face and chest as well as an inability to open her mouth against resistance. The muscle which was most likely injured is the

- A. lateral pterygoid muscle
- B. masseter muscle
- C. medial pterygoid muscle
- D. orbicularis oris muscle
- E. temporalis muscle

**Answer: A**

#### **Explanation:**

The lateral pterygoid muscles consist of two heads: an upper head arising from the infratemporal surface of the greater wing of the sphenoid bone and a lower head arising from the lateral pterygoid plate. The lateral pterygoids act to pull the mandible forward in the process of opening the jaw against resistance. Its other actions include protracting the mandible and moving it from side to side while chewing food.

#### QUESTION 16

A 55-year-old female comes to the physician with a dry cough of three weeks' duration. The cough is not associated with sputum or blood production and she is afebrile. She has a medical history of rheumatoid arthritis, peptic ulcer disease and hypertension for which is receiving treatment. The most likely cause of her chief complaint is:

- A. aspirin
- B. hydrochlorothiazide
- C. infliximab
- D. lisinopril
- E. metronidazole

**Answer: D**

#### **Explanation:**

ACE inhibitors such as lisinopril block the conversion of angiotensin I to angiotensin II which leads to decreased arteriolar resistance, decreased aldosterone levels, decreased glomerular filtration rates and increased renin levels. They are used to treat hypertension, diabetic nephropathy and heart failure. Inhibition of the angiotensin converting enzyme (ACE) also prevents inactivation of bradykinin which can cause a persistent dry cough and angioedema due to elevated bradykinin levels. Other side effects of ACE inhibitors include teratogenesis, increased creatinine, hyperkalemia and hypotension. They are contraindicated in patients with bilateral renal stenosis and C1 esterase inhibitor deficiency. This patient who has developed a cough due to lisinopril use should be switched to an angiotensin II receptor blocker such as losartan.



### QUESTION 17

A 12-year-old female is brought to the physician by her mother due to a severe sore throat. She has significant pain with swallowing and generally feels tired. Her mother also reports that the patient has had a high fever for the past four days. Physical examination reveals an erythematous patch on the upper posterior pharynx and tenderness of the cervical lymph nodes. Vitals reveal a temperature of 39.5°C (103.1°F). The nerve responsible for this patient's throat pain is also involved in

- A. head rotation to opposite side
- B. movement of intrinsic tongue muscles
- C. sensation of the lower jaw
- D. sensory input from carotid sinus baroreceptors
- E. taste in the anterior two thirds of the tongue

**Answer: D**

#### **Explanation:**

Afferent nerve fibers (sensory) travel to the central nervous system (CNS) while efferent nerve fibers (motor) travel away from the CNS. The glossopharyngeal nerve (cranial nerve IX) carries general somatic sensation from the posterior part of the upper pharynx, eustachian tube, middle ear and posterior one third of the tongue. It also conveys afferent fibers from the carotid sinus baroreceptors, carotid body chemoreceptors and taste sensation from the posterior one third of the tongue as well as parasympathetic efferents to the parotid gland via the otic ganglion. Difficulty swallowing (dysphagia) and painful swallowing (odynophagia) can result from a variety of causes including abnormal motor innervation to the muscles of the pharynx or esophagus (vagus nerve), disorders of esophageal motility and of the lower esophageal sphincter (achalasia) and compression of the pharynx or esophagus from nearby structures such as in left atrial enlargement.

### QUESTION 18

A 35-year-old male comes to the physician due to watery diarrhea of two weeks' duration. He also has a low-grade fever, fatigue and weight loss of 5kg (11 lbs) over the past month. Laboratory findings include a CDT cell count 70 cells/mm<sup>3</sup>. To find the cause of his diarrhea, the next best step is a test involving +

- A. acid fast staining of the stool
- B. cysts with multiple nuclei in the stool
- C. peripheral blood smears
- D. silver staining of the stool
- E. toxins in the stool

**Answer: A**

#### **Explanation:**

Cryptosporidium is a protozoa commonly associated with chronic watery diarrhea in HIV/AIDS patients with CD cell counts less than < 100 cells/mm<sup>3</sup>. It causes a milder diarrhea in immunocompetent hosts and can be treated with nitazoxanide and prevented by filtering the city water supplies. The diagnosis can be made by acid fast staining of a stool specimen which reveals the presence of acid-fast oocysts.

### QUESTION 19

A 25-day-old male is brought to the physician due to seizures, rigidity and frequent viral infections. Physical examination reveals a neonate with cyanosis in the lower extremities. The most likely cause of these findings is a

- A. defect in the IL-2R gamma chain
- B. defect in the lysosomal trafficking regulation gene
- C. defect in the tyrosinase kinase gene
- D. deletion in chromosome 22q11.2
- E. mutation in the STAT3 gene

**Answer: D**

**Explanation:**

The patient most likely has thymic aplasia which is also known as DiGeorge syndrome. It is caused by a deletion in chromosome 22q11.2 which leads to failure of the third and fourth pharyngeal pouches to develop. The features of DiGeorge syndrome include conotruncal cardiac anomalies such as tetralogy of Fallot and truncus arteriosus, an absent thymus gland which leads to T-cell deficiency and frequent viral infections, and hypocalcemia due to a hypoplastic parathyroid. The congenital heart defect may lead to cyanosis and the hypocalcemia can present with seizures and tetany. Laboratory findings include decreased T cell levels, decreased parathyroid hormone, decreased calcium levels and a thymic shadow on a chest x-ray.

**QUESTION 620**

A 65-year-old female with end stage renal failure comes to her physician with a rash and is diagnosed with Lyme disease. Review of her medical records reveals severe allergic reactions to penicillin and macrolides. The most appropriate treatment for this patient's current disease is

- A. demeclocycline
- B. doxycycline
- C. metronidazole
- D. oxytetracycline
- E. tetracycline

**Answer: B**

**Explanation:**

Tetracyclines such as doxycycline are antibiotics commonly used to treat infections such as Rocky Mountain spotted fever, typhus and Lyme disease, which are all caused by spirochetes. They are also used for the treatment of acne, sexually transmitted diseases and for susceptible organisms in patients who are allergic to penicillin. The treatments for Lyme disease without neurologic symptoms or heart block include doxycycline and amoxicillin. Doxycycline and minocycline are tetracyclines excreted largely by routes other than the kidneys. They are secreted in an inactive form into the intestinal lumen and eliminated in the feces. The other tetracyclines listed are concentrated by the liver in the bile and excreted in the urine and feces unchanged hence, they are not the best treatment option in this patient with renal failure. Metronidazole is not used to treat Lyme disease.

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