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QUESTION 1

A grandmother undergoing chemotherapy for cancer in a hospital was exposed to a grandchild with chickenpox. In order to prevent a clinical complication of varicella or disseminated zoster in the grandmother, which of the materials listed below should be used as an appropriate medical intervention?

- A. acyclovir
- B. indinavir
- C. killed varicella-zoster virus (VZV) vaccine
- D. live attenuated VZV vaccine
- E. subunit VZV vaccine

Correct Answer: A

Section: Microbiology/Immunology Prevention of varicella and disseminated zoster rests on the administration of acyclovir. Killed varicellazoster virus (VZV) vaccine has not been shown to be effective. Furthermore, if the immunological system has been compromised the immune responses will be very weak and of questionable value (choice C). Live attenuated VZV vaccines cannot be given to immunocompromised individuals because vaccination can be lethal (choice D). Subunit VZV vaccines are not available, and will be of little value to persons with suppressed immunological responses (choice E). Indinavir is a protease inhibitor used for the treatment of AIDS, not for varicella or zoster (choice B).

QUESTION 2

A 47-year-old gardener receives an insect sting while pruning some rose bushes. Within a few minutes the area around the sting is swollen and red. The swelling is mostly the result of which of the following?

- A. decreased plasma oncotic pressure
- B. increased hydrostatic pressure
- C. increased vascular permeability
- D. lymphatic obstruction
- E. venous obstruction

Correct Answer: C

Section: Pathology and Path physiology Following tissue injury (in this case caused by the insect sting), vasoactive inflammatory mediators originating from both cellular and humoral sources are released at the site of injury. These produce vasodilation of arterioles and increased blood flow producing the redness, and increased vascular permeability of enules allowing the formation of an exudates that produces swelling. All of the other choices can produce edema, but do not feature an increase in vascular permeability (they produce noninflammatory edema). Decreased plasma oncotic pressure (choice A) can result from either excessive loss (e.g., nephrotic syndrome) or decreased synthesis (e.g., cirrhosis, protein malnutrition) of plasma proteins, principally albumin. Increased hydrostatic pressure (choice B) occurs, for example, in heart failure where the pressure builds up behind the failing pump. Lymphatic obstruction (choice D) occurs where there is blockage to the normal lymphatic drainage. This could be due to the growth of an obstructing cancer or to inflammation and fibrosis (e.g., postsurgery, filariasis). Venous obstruction (choice E) leads to increased

hydrostatic pressure as the blood backs up behind the obstruction.

QUESTION 3

Exhibit:

A. calcium-ATPase

B. GLUT2

C. Na^+ , K^+ -ATPase

D. Na^+ ; Ca^{2+} countertransport protein

E. SGLT-1

Please refer to the exhibit.

Which of the following proteins uses the sodium electrochemical gradient to actively transport a solute into the cell?

A. A

B. B

C. C

D. D

E. E

Correct Answer: E

Section: Physiology SGLT-1 is a sodium-dependent cotransport protein that uses the sodium electrochemical gradient to actively move glucose into the cell. GLUT2 (choice B) does transport glucose, but it is a facilitated diffusion carrier that moves glucose down its concentration gradient. The Na, K-ATPase (choice C) is a primary active transport protein. It uses the energy liberated from ATP hydrolysis to actively transport sodium and potassium. It establishes and maintains the sodium electrochemical gradient. The sodium: calcium countertransport protein (choice D, also termed NCX) uses the sodium electrochemical gradient to move calcium ions out of, not into, the cell. The calcium ATPase (choice A, also termed PMCA) is a primary active transport protein that actively transports calcium out of the cell. Both NCX and PMCA serve to maintain a low intracellular calcium concentration.

QUESTION 4

Which of the following is likely to cause a negative free-water clearance by the kidney?

A. central diabetes insipidus

B. demeclocycline, an inhibitor of the renal tubular actions of ADH

C. nephrogenic diabetes insipidus

- D. water deprivation
- E. water drinking

Correct Answer: D

Section: Physiology Water deprivation will eventually increase extracellular fluid osmolality, which triggers release of ADH. ADH acts on the collecting duct to increase water reabsorption, thus making the excreted urine more concentrated via a negative free-water clearance. Choices B and C will reduce the sensitivity of the collecting duct to normal circulating ADH. Choices A and E will reduce the amount of ADH secreted by the posterior pituitary.

QUESTION 5

A 26-year-old woman with cerebral palsy complains of severe pain associated with spasms in her leg muscles. Which of the following drugs is used in cerebral palsy to reduce skeletal muscle spasticity by an action on cholinergic nerve endings?

- A. baclofen
- B. botulinum toxin
- C. dantrolene
- D. diazepam
- E. tubocurarine

Correct Answer: B

QUESTION 6

Protein zero (P0) is the predominant protein in myelin in the peripheral nervous system and its function is to stabilize adjacent plasma membranes by interaction with similar P0 molecules. Which of the following cells manufacture P0?

- A. fibrous astrocytes
- B. microglia
- C. oligodendrocytes
- D. protoplasmic astrocytes
- E. Schwann cells

Correct Answer: E

Section: Anatomy Schwann cells produce myelin in the peripheral nervous system whereas oligodendrocytes produce myelin in the central nervous system. Oligodendrocytes manufacture the proteolipid protein, the functional equivalent to P0 in the central nervous system. Fibrous (choice A) and protoplasmic (choice D) astrocytes are supportive cells which play a role in the regulation of brain metabolism. Microglia (choice B) are mesodermal in origin and have phagocytotic activity in the central nervous system.

QUESTION 7

A 14-year-old female presenting with polyuria is subsequently diagnosed with Type I diabetes mellitus. The polyuria results from an osmotic diuresis that involves primarily which part of the renal tubule?

- A. collecting duct
- B. glomerulus
- C. juxtaglomerular apparatus
- D. proximal tubule
- E. thick ascending limb of the loop of Henle

Correct Answer: D

QUESTION 8

Multiple sclerosis is a relatively common nervous system demyelinating disease. It is autoimmune and restricted to the central nervous system. Nerve conduction velocity is depressed in almost all affected individuals. Manipulations which prolong action potential duration seem to mitigate symptoms, possibly by facilitating conduction through sections of membrane which are no longer myelinated. Application of which type of drug might be expected to prolong action potential duration and thus be a potential therapeutic tool?

- A. activates potassium channels
- B. blocks L-type calcium channels
- C. blocks potassium channels
- D. blocks sodium channels
- E. increases sodium channel inactivation

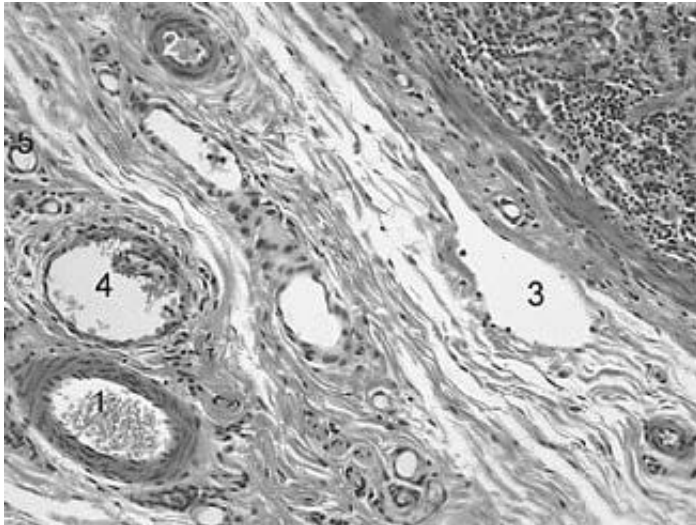
Correct Answer: C

Section: Physiology In clinical trials, a class of drugs, the aminopyridines, that blocks certain potassium channels has shown some promise for symptomatic relief of the symptoms of multiple sclerosis. The neuronal action potential is terminated by sodium channel inactivation and potassium channel activation. A drug that blocks potassium channels would thus prolong the action potential. Activating potassium channels (choice A) or increasing sodium channel inactivation (choice E) would shorten the action potential. Blocking sodium channels (choice D) would either shorten the action potential or block it altogether. Since calcium channels are not involved in the neuronal action potential, calcium channel blockade would not be expected to have much effect (choice B).

QUESTION 9

Clinical edema results when lymphatic vessels are blocked or when the volume of extracellular fluid exceeds the drainage capacity of the lymphatic vessels. Which of the following numbered structures in following figure is a lymphatic

vessel?



- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

Correct Answer: C

Section: Anatomy An irregular outline, a thin wall, and the lack of erythrocytes in the lumen characterize lymphatic vessel. Arterioles (choices A and B) have thicker walls and contain erythrocytes. Venules (choice D) are thin-walled but they contain erythrocytes. Capillaries (choice E) are small in diameter and they contain erythrocytes.

QUESTION 10

A 3-month-old infant who otherwise appeared normal during the first 2 months of life except for a bout of hyperbilirubinemia is now clearly exhibiting developmental delay. In addition, the infant's hair has become grayish and dull and there is a stubble of broken hair over the occiput and temporal regions. The facial appearance has also changed such that the infant has very pudgy cheeks, abnormal eyebrows, and sagging jowls. The occurrence of frequent convulsions was the stimulus for the parents to bring their child to the emergency room. These rapidly deteriorating symptoms are indicative of which of the following disorders?

- A. Crigler-Najjar syndrome type I
- B. Gilbert syndrome
- C. hemochromatosis
- D. Menkes disease
- E. Refsum disease

Correct Answer: D

Section: Biochemistry Menkes disease is an X-linked recessive disorder that is manifest by a defect in copper absorption. This defect leads to dysfunction of numerous enzymes that need copper as a cofactor, leading to the typical symptoms observed in this patient. In fact, Menkes disease is also referred to as steely hair disease, because of the characteristic brittleness of the hair, which is easily broken. Crigler-Najjar syndrome type I (choice A) is also due to defective bilirubin metabolism as a result of a loss of UDPglucuronosyltransferase (UGT) activity. UGT is required to transfer 2 moles of glucuronic acid to bilirubin, generating bilirubindigluconide, which makes bilirubin much more water soluble and therefore facilitates its excretion. Crigler-Najjar syndrome results in nonhemolytic icterus (jaundice) within the first few days of life and is generally fatal during neonatal life due to severe kernicterus. Gilbert syndrome (choice B) results from a defect in bilirubin metabolism. It is typically diagnosed in young adults and is characterized by mild, chronic, and unconjugated hyperbilirubinemia without associated hemolysis. Hemochromatosis (choice C) is the term applied when organ structure and function are impaired by the presence of excess amounts of iron. The liver, heart, pancreas, skin, joints, and endocrine organs are the principal tissues affected by iron accumulation. Symptoms include cirrhosis, cardiomyopathy, arthritis, abnormal skin pigmentation, and hypogonadism, as well as diabetes mellitus. Refsum disease (choice E) results from a defect in the metabolism of phytanic acid, a plant lipid which must be oxidized by a separate pathway from that of animal fats. Cardinal symptoms include retinitis pigmentosa, peripheral neuropathy, and cerebellar ataxia.

QUESTION 11

The electrocardiogram of a 66-year-old male with a history of atherosclerotic heart disease reveals an irregular, but rapid heart rate. The QRS complexes are normal but no P-waves can be seen. What is the most likely reason for these findings?

- A. atrial fibrillation
- B. Paroxysmal ventricular tachycardia
- C. Right bundle branch block
- D. Sinus tachycardia
- E. Wolff-Parkinson-White syndrome

Correct Answer: A

Section: Physiology Atrial fibrillation is a continuous, chaotic reentry of electrical impulses within the atrial myocardium that arises in a diseased or stretched left atrium. The chaotic patterns of atrial excitation prevent P- waves from being seen in the electrocardiogram. The ventricular response is rapid and irregular. In all the other alternatives (choices BE), a P-wave should be distinguishable in some part of the electrocardiogram, although not necessary in a constant relationship to the QRS complex.

QUESTION 12

Sara is a 15-year-old healthy female. With which of the following would one expect a girl of her age to spend a lot of time?

- A. a mixed group of peers
- B. adults
- C. animals

D. furry toys

E. older females

Correct Answer: A

Section: Behavioral Science and Biostatistics An adolescent veers away from childish toys and develops an interest in the opposite sex. Peer relationships include members of the opposite as well as the same sex.

QUESTION 13

Lipoprotein lipase (LPL) is the endothelial cell-associated enzyme necessary for release of fatty acids from circulating lipoproteins. Which of the following apolipoproteins is required to activate LPL-mediated release of fatty acids from chylomicrons?

A. apo A

B. apo

C. apo

D. apo CII

E. apo E

Correct Answer: D

QUESTION 14

A 6-year-old girl has been having recurrent pyogenic bacterial infections of the sinus and respiratory tract. The latest one has been caused by *N. meningitidis*. The results of her diagnostic tests are shown in below figure.

TEST	RESULT
White cell count	Normal
T cell count	Normal
Production of IgM to polysaccharides	Normal
Production of anti-DNA antibodies	Not detected
Levels of complement components C3 and C5 to C8	Low
Levels of thyroid-stimulating hormone	Normal
Levels of immunoglobulins	Normal
Intracellular killing of microbes by neutrophils	Normal

These results are consistent with a diagnosis of which of the following?

A. chronic granulomatous disease

B. deficiency in the opsonization of microbes by phagocytes

C. Graves disease

- D. systemic lupus erythematosus
- E. Wiskott-Aldrich syndrome

Correct Answer: B

Section: Microbiology/Immunology The diagnostic tests ordered by the physician are consistent with a deficiency in the C3, C5C8 components of complement. Individuals with these deficiencies have recurrent pyogenic infections, and show enhanced susceptibility to meningococcal infections. All other choices are not consistent with the laboratory findings. Chronic granulomatous disease (choice A) entails a defect in the intracellular killing of microbes by neutrophils. Graves disease (choice C) involves autoantibody production to thyroid-stimulating hormone receptors. Systemic lupus erythematosus (choice D) involves production of antinuclear antibodies (ANA). Wiskott-Aldrich syndrome (choice E) is associated with recurrent pyogenic infections, but is due to an inability of plasma cells to produce IgM against bacterial polysaccharides, and it occurs only in male infants.

QUESTION 15

Which of the following drugs can be used in rheumatoid arthritis with the lowest probable incidence of GI complications?

- A. aspirin
- B. celecoxib
- C. ibuprofen
- D. misoprostol
- E. naproxen

Correct Answer: B

Section: Pharmacology A through C and E are NSAIDs. NSAIDs have long been drugs of first choice in arthritis treatment. Their primary mechanism of action in arthritis appears to be inhibition of COX, an enzyme required for the synthesis of inflammatory and other prostaglandins. Two forms of COX are present in the body: COX-1, which is required for synthesis of several useful prostaglandins (e.g., PGE1, a cytoprotective agent in the stomach), and COX-2, the isoform responsible for synthesis of prostacyclin as well as most of the damaging prostaglandins. Celecoxib is more selective for COX-2 and thus has a lower incidence of adverse GI effects. The older NSAIDs (choices A, C, and E) inhibit both COX-1 and COX-2 with less selectivity and thus reduce protective prostaglandins, resulting in a high incidence of GI disorders, especially peptic ulceration. Misoprostol (choice D) is a PGE1 analog that is used with NSAIDs to reduce peptic ulceration; unfortunately it causes a high incidence of diarrhea.

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