Damjanov: Pathophysiology

Test Bank

Set 1 (questions 1-25)

MULTIPLE CHOICE

1. Cytoplasmic inclusion bodies are found in the liver cells of chronic alcoholics. These inclusions, known as Mallory's hyaline, are composed of damaged intermediate filaments covalently bound to
   A. cytochrome P450
   B. alanine transaminase
   C. ubiquitin
   D. actin
   E. myosin

   ANS: C
   Damaged intermediate filaments, like many other damaged cytoplasmic proteins, are covalently bound to ubiquitin. This process marks the proteins for degradation by cytosolic proteases.

2. Estrogen produced by certain ovarian tumors causes thickening of the endometrium, which most often represents endometrial
   A. hyperplasia
   B. hypertrophy
   C. atrophy
   D. dysplasia
   E. metaplasia

   ANS: A
   Estrogen stimulates the proliferation of endometrial cells, causing thickening of the endometrium. Such thickening, which is attributable to an increased number of cells, is called hyperplasia. Hypertrophy implies an increased cell mass due to enlargement of individual cells, whereas atrophy means reduced size of the cells or tissues. Dysplasia and metaplasia imply changes in cell differentiation that may occur only if estrogenic stimulation is very long or combined with the action of additional adverse stimuli, such as carcinogens.

3. Cell death caused by the action of perforin, which is produced by cytotoxic T lymphocytes in certain cell-mediated immune reactions, is associated with
   A. activation of initiating and effector caspases
   B. inhibition of adenosine triphosphate (ATP)-dependent sodium/potassium pump
   C. increased water content of the cytoplasm
   D. influx of sodium into the cytoplasm
   E. activation of growth factor XORs on the cell surface

   ANS: A

Through the action of perforin, T lymphocytes induce apoptosis, a form of cell death, characterized by activation of "suicide pathway enzymes," the most notable of which are caspases. Inhibition of the ATP-dependent sodium/potassium pump, resulting in an influx of water and sodium into the cell cytoplasm, is typical of ischemic or toxic cell injury leading to vacuolar (hydropic) change or necrosis. Cell surface growth factor receptors are not activated by perforin.

4. Which of the following enzymes plays a crucial role in the scavenging of free reactive oxygen radicals?
   A. alkaline phosphatase
   B. cytochrome C oxidase
   C. catalase
   D. caspase-3
   E. adenosine triphosphatase

   ANS: C
   Catalase is a peroxisomal enzyme that inactivates superoxide, one of the three main free oxygen radicals. The other two oxygen radicals are hydrogen peroxide and hydroxyl radical. Other enzymes listed here do not act as scavengers of free oxygen radicals.

5. Which of the following pathogenetic mechanisms plays a role in the pathogenesis of fatty liver caused by chronic alcohol abuse?
   A. increased influx of free fatty acids into the liver
   B. decreased esterification of free fatty acids to triglycerides in the liver
   C. increased oxidation of free fatty acids
   D. increased production of lipoproteins
   E. increased degradation of hepatic triglycerides

   ANS: A
   Alcohol leads to increased hepatic influx of free fatty acids (FFAs) from peripheral stores. Alcohol also causes increased intrahepatic esterification of FFAs to triglycerides, decreased oxidation of FFAs, and because of protein malnutrition it reduces the export of lipids in the form of lipoproteins.

6. Fibrinoid necrosis is typically seen in the
   A. myocardium
   B. lung parenchyma
   C. arteries and arterioles
   D. brain parenchyma
   E. adrenal cortex

   ANS: C
   Fibrinoid necrosis typically occurs in arteries affected by immune-mediated vasculitis or in arteries and arterioles damaged by hypertension of sudden onset.

7. A 60-year-old man died two days after a thrombotic occlusion of the right coronary artery. Histologically, the myocardial cells appeared necrotic and had small condensed dark blue nuclei. This nuclear change is called

A. karyolysis
B. karyorrhexis
C. pyknosis
D. heterochromatin
E. euchromatin

ANS: C
Condensation of nuclei in necrotic cells is called pyknosis (from the Greek word *pyknos,* meaning dense). Karyolysis and karyorrhexis are two other nuclear changes found in necrotic cells. Karyolysis is characterized by dissolution of the nucleus, whereas karyorrhexis is associated with fragmentation of the nucleus into smaller pieces. Heterochromatin and euchromatin are parts of the normal nucleus: heterochromatin represents the condensed transcriptionally active chromatin and euchromatin represents the finely dispersed inactive chromatin.

8. A 66-year-old woman had a myocardial infarction. Laboratory testing performed 12 hours after the onset of symptoms disclosed elevated blood concentrations of
A. cytochrome oxidase
B. catalase
C. superoxide dismutase
D. xanthine oxidase
E. creatine kinase

ANS: E
Creatine kinase, an enzyme found in muscle cells, is released from injured muscle cells. It occurs in two isoforms: isoenzyme creatine kinase MB is found in the myocardial cells and is useful for diagnosing myocardial infarcts. The isoenzyme MM is found in the skeletal muscle cells and is elevated in blood after muscle injury or in patients who have myositis.

9. Which of the following biologically active substances produced by endothelial cells leads to relaxation of smooth muscle cells and inhibits platelet aggregation?
A. thromboxane
B. P-selectin
C. angiotensin II
D. nitric oxide
E. endothelin

ANS: D
Nitric oxide, a very small molecule produced by endothelial cells, was originally known as the endothelial cell-derived relaxation factor. It induces relaxation of vascular smooth muscle cells and also inhibits the aggregation of platelets. Endothelin, thromboxane A_2, and angiotensin II cause vascular constriction. P-selectin mediates the rolling of leukocytes and is essential for subsequent adhesion of leukocytes to endothelial cells during inflammation.

10. A 40-year-old man was hospitalized for high fever and severe headache. A localized cavitary lesion was found in the brain by computerized tomography. A needle biopsy during exploratory craniotomy revealed that the lesion contained numerous neutrophils, many of which were dead or dying. This lesion most likely represents a(n)

A. abscess
B. caseous granuloma
C. noncaseous granuloma
D. gumma
E. malignant brain neoplasm

ANS: A
This lesion is an abscess, a localized purulent inflammation caused by bacteria. Abscesses are cavities filled with pus--an exudate composed of neutrophils, many of which are dead or dying. A granuloma is composed of epithelioid macrophages, lymphocytes, and multinucleated giant cells and typically does not contain pus. A gumma consists of macrophages, lymphocytes, multinucleated giant cells, and plasma cells and also does not contain neutrophils. No neoplastic cells were seen in this case, which excludes the diagnosis of neoplasm.

11. At the autopsy of a 45-year-old Caribbean man who had rheumatic carditis, the pathologist noticed that the outer surface of the heart and the inner surface of the pericardial sac were covered with a "shaggy" whitish-yellow layer of stringy material. The exudate apparently caused adhesions between the two layers of the pericardium, but nevertheless these two layers could be easily separated. The separated layers of the pericardium had a "bread and butter sandwich-like" appearance. This type of pericarditis is best classified as
A. serous
B. fibrinous
C. hemorrhagic
D. fibrous
E. purulent

ANS: B
The surface of the pericardial sac is covered with fibrin, and accordingly this form of pericarditis is classified as fibrinous. In serous pericarditis there are no visible surface deposits, but the pericardial cavity is filled with serous fluid. In hemorrhagic pericarditis the pericardial cavity contains blood. In fibrous pericarditis the two layers of pericardium are attached to one another by fibrous connective tissue, which encases the heart, thereby constricting it (constrictive pericarditis). In purulent pericarditis the pericardium is filled with pus, i.e., a viscous yellow fluid.

12. Which of the following mediators of inflammation is a biogenic amine stored in the cytoplasmic granules of mast cells, basophils, and platelets, causing increased permeability of venules in the tissue upon its release?
A. nitric oxide
B. prostaglandin E
C. platelet activating factor
D. interleukin (IL-1)
E. histamine

ANS: E

Histamine is a biogenic amine stored in the granules of mast cells, basophils, and platelets. Upon degranulation of these cells, it increases the permeability of venules, causing edema. All other mediators of inflammation listed here are not present in a prestored form and require time to be synthesized prior to release.

13. Fibrin degradation products are formed from fibrin through the direct enzymatic action of
    A. complement C3a
    B. Hageman factor
    C. thrombin
    D. plasmin
    E. phospholipase A_2

    ANS: D
    Plasmin is the principal fibrinolytic enzyme involved in fibrinolysis of fibrin and accounts for the formation of fibrin degradation products (also known as fibrin split products). Other biologically active substances listed here do not have fibrinolytic activity, and some of them, like thrombin, have a diametrically opposite effect on the coagulation process, promoting fibrin formation from fibrinogen. Hageman factor is known as factor XII of the coagulation system and is responsible for the activation of the intrinsic pathway of coagulation. Hageman factor also may cause fibrinolysis indirectly, because it promotes conversion of plasminogen into plasmin.

14. Contraction of the fibrous or fibrovascular granulation tissue in a wound healing by secondary intention occurs as a result of the action of
    A. angioblasts
    B. myofibroblasts
    C. macrophages
    D. endothelial cells
    E. vascular smooth muscle cells

    ANS: B
    Myofibroblasts have hybrid features of fibroblasts and smooth muscle cells. Like fibroblasts they can synthesize collagen, and like smooth muscle cells they can contract. Contraction of myofibroblasts can reduce the surface area of an open wound to 10% of its original size and is most evident in wounds healing by secondary intention.

15. Which of the following cells plays the key role in chronic inflammation and is the main source of cytokines, arachidonic acid metabolites, and proteases?
    A. neutrophils
    B. plasma cells
    C. B lymphocytes
    D. T lymphocytes
    E. macrophages

    ANS: E

Macrophages are the main effector cells in chronic inflammation. These cells are multifunctional and secrete numerous mediators of inflammation, such as cytokines, arachidonic acid metabolites, and various proteases. Neutrophils are typically found in acute inflammation. Plasma cells and B lymphocytes secrete immunoglobulins, whereas T lymphocytes mostly secrete cytokines.

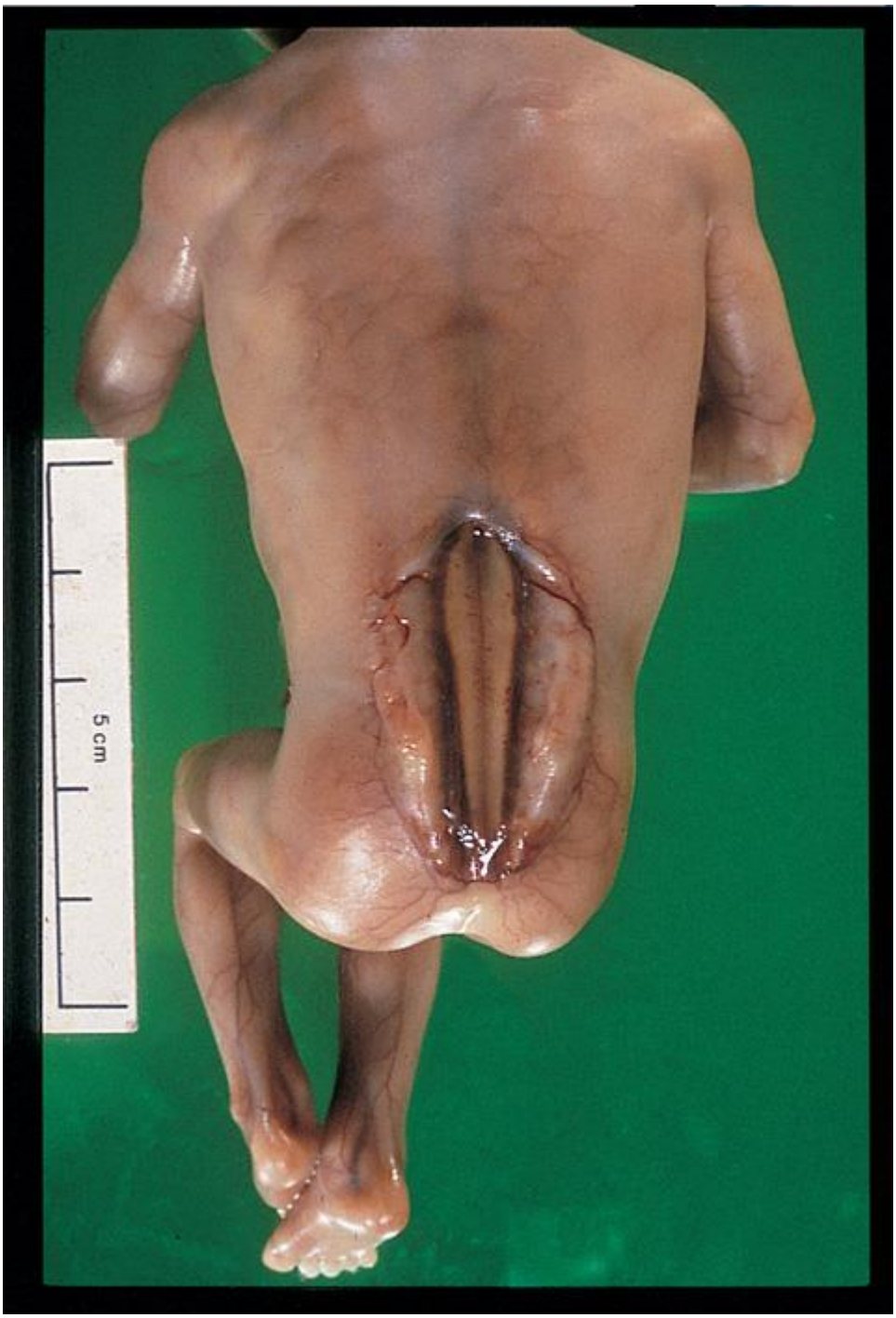
16. The central part of a caseous granuloma caused by infection with *Mycobacterium tuberculosis* contains
    A. lymphocytes
    B. macrophages
    C. multinucleated giant cells
    D. fibroblasts
    E. necrotic amorphous material

    ANS: E
    Typical caseating granulomas of tuberculosis consist of a central zone of necrosis surrounded by a rim of macrophages, multinucleated giant cells, and lymphocytes. In longstanding granulomas there are also fibroblasts, which become more prominent during fibrous healing

17. Sterile suture material remaining in the tissue after surgery typically elicits the formation of
    A. abscesses
    B. gummas
    C. caseating granulomas
    D. foreign body giant cell granulomas
    E. sarcoidosis

    ANS: D
    Like all particulate foreign material, sutures left inside the tissue elicit a foreign body giant cell granulomatous reaction. Abscesses are found if the material is infected. Gummas are typical of syphilis. Caseating granulomas are typical of infection with mycobacteria or certain fungi, such as *Histoplasma capsulatum.* Sarcoidosis is a disease of unknown etiology characterized by the formation of noncaseating granulomas.

18. Myelomeningocele is a congenital malformation best classified as



A. atresia
B. ectopia
C. dysplasia
D. dysraphia
E. agenesis

ANS: D

Dysraphia is a failure of the midline fusion of embryonic primordia. Myelomeningocele results from incomplete fusion of the embryonic neural tube and the overlying vertebral arches and soft tissue and skin on the back.

19. Syndactyly and esophageal atresia develop because of a lack of embryonic cell
    A. apoptosis
    B. fusion
    C. migration
    D. differentiation
    E. invagination

    ANS: A
    Syndactyly and esophageal atresia result from a lack of apoptosis, which is supposed to occur during the formation of the fingers or esophagus. Fingers are formed by programmed death of cells in the embryonic limb bud, and if these cells do not die, the fingers remain fused to each other. Apoptosis in the central part of the solid foregut strand of cells leads to the formation of the esophageal lumen, and if it does not occur, the esophagus remains atretic.

20. An 8-year-old boy was evaluated for mental retardation. Additional findings included microcephaly, ataxic gait, epilepsy, and inability to talk. The boy had a happy expression on his face. Chromosomal studies revealed deletion of q11–13 of chromosome 15. Neither of his parents and none of his siblings showed similar signs of the disease. This disease is an example of
    A. autosomal dominant inheritance
    B. autosomal recessive inheritance
    C. x-linked dominant inheritance
    D. genetic imprinting
    E. mitochondrial inheritance

    ANS: D
    This child has Angelman's syndrome, a disease representing the best example of genetic imprinting. In Angelman's syndrome the deletion on chromosome 15 is of maternal origin, whereas in the closely related Prader-Willi syndrome the defect is of paternal origin.

21. A mentally retarded child with characteristic facial features (flat facial profile, oblique palpebral fissures, low-bridged nose, epicanthal fold, enlarged tongue protruding through the opened mouth) was examined. A karyogamy contained 46 chromosomes, but there was a 14;21 translocation in both the child and the mother. Cytogenetic studies should be performed on the fetus in the next pregnancy because
    A. all subsequent children will have this syndrome
    B. approximately 75% of future children will be affected
    C. approximately 50% of future children will be affected
    D. the incidence of this syndrome is higher if the mother is the carrier of translocation
    E. the incidence of this syndrome is higher if the father is the carrier of translocation

    ANS: D

This child has Down syndrome related to robertsonian translocation of chromosome 21 to chromosome 14. Recurrence of this form of Down syndrome in future offspring of the same couple is higher if the mother is the carrier of translocation (15%) than if the father is the carrier (1%).

22. A 20-year-old woman was examined for infertility. She was short (150 cm), had infantile genitalia, had no pubic hair, and never had menstruated. She showed webbing of the neck, had cubitus valgus, and widely spaced nipples. X-chromosome mosaicism was found during the cytogenetic examination. This chromosomal anomaly is a consequence of
A. nondisjunction during second meiotic division of the ovum
B. nondisjunction during first meiotic division of the ovum
C. nondisjunction during spermatogenesis
D. nondisjunction during mitotic division in early embryogenesis
E. polyspermia

ANS: D
This woman has Turner's syndrome, which most often occurs with a 45, X karyotype. The missing X chromosome in these cases is deleted by nondisjunction during meiosis. A significant number of Turner's syndrome patients have mosaicism, which results from mitotic errors during early embryogenesis.

23. A 25-year-old man with short limbs has achondroplasia. No one in his family has had the disease. He married a woman of normal height and wanted to know their chances of having a child with the same disease. As a consultant you say that
A. 75% of their children will be affected
B. in every pregnancy the chances are 50% that a child will be affected
C. the father has a spontaneous mutation that is not transmitted to his progeny
D. 25% of all of their children will be affected
E. only boys will be affected

ANS: C
Achondroplasia is an autosomal dominant disease and is thus passed on to approximately 50% of all children.

24. Which abnormality is found in the abnormally fragile X-chromosome in the fragile X syndrome?
A. translocation
B. deletion
C. imprinting
D. hypermethylation
E. amplification of tandem trinucleotide repeats

ANS: E
The fragile site on the X-chromosome in the fragile X syndrome shows an expanded trinucleotide repeat. This finding provides an explanation for the clinical phenomenon known as "anticipation," whereby a hereditary disease becomes more severe with each generation.

25. A 4-year-old boy was examined for prolonged bleeding after minor surgery and spontaneous bleeding into his knee joints. Deficiency of coagulation factor VIII was demonstrated during the hematological work-up. This disease is inherited as
    A. autosomal dominant
    B. autosomal recessive
    C. X-linked recessive
    D. X-linked dominant with variable penetrance
    E. X-linked dominant with maternal imprinting

    ANS: C
    This boy has hemophilia A (congenital deficiency of factor VIII), a bleeding disorder inherited as an X-linked recessive trait. Mothers are carriers of this trait but are asymptomatic. Only boys are affected, but the asymptomatic daughters can be carriers of the trait. It is worth remembering that X-linked dominant diseases are extremely rare. The only major autosomal congenital bleeding disorder is von Willebrand's disease, which can be inherited as an autosomal dominant or recessive trait.