LEC 3 Q - PATHOLOGY

1. **What factor does NOT influence the cellular response to injury?**
   A) Type of injury
   B) Severity of injury
   C) Age of the patient
   D) Duration of injury
   Answer: C
2. **Which of the following tissues is MOST sensitive to ischemia?**
   A) Skeletal muscle
   B) Cardiac muscle
   C) Liver
   D) Skin
   Answer: B
3. **What occurs after 30 minutes of cardiac ischemia?**
   A) Reversible injury
   B) Myocardial infarction (necrosis)
   C) No significant damage
   D) Increased blood flow
   Answer: B
4. **Which of the following mechanisms leads to cell swelling during hypoxia?**
   A) Increased ATP production
   B) Na/K pump failure
   C) Enhanced protein synthesis
   D) Decreased membrane permeability
   Answer: B
5. **Ischemia-reperfusion injury primarily results from the generation of which of the following?**
   A) Lactic acid
   B) Reactive oxygen species (ROS)
   C) Free radicals
   D) Nitric oxide
   Answer: B
6. **Which of the following is NOT a source of reactive oxygen species (ROS)?**
   A) Hypoxia
   B) Chemical injury
   C) Nutrient excess
   D) Radiation
   Answer: C
7. **Direct-acting toxins cause damage by:**
   A) Metabolizing into reactive forms
   B) Binding to critical cellular components

C) Inducing inflammation
D) Enhancing ATP production
Answer: B

8. **What is the primary effect of endoplasmic reticulum (ER) stress?**
   A) Increased cellular metabolism
   B) Apoptosis due to misfolded proteins
   C) Enhanced protein synthesis
   D) Decreased oxidative stress
   Answer: B
9. **What initiates the apoptotic pathway in response to DNA damage?**
   A) Increased ATP production
   B) p53 activation
   C) Enhanced glycolysis
   D) Increased calcium levels
   Answer: B
10. **In the context of inflammation, which cells are primarily responsible for secreting damaging substances?**
    A) Erythrocytes
    B) Neutrophils, macrophages, and lymphocytes
    C) Endothelial cells
    D) Fibroblasts
    Answer: B
11. **Which of the following statements about ischemia is TRUE?**
    A) Ischemia always leads to immediate cell death.
    B) Skeletal muscle is more sensitive to ischemia than cardiac muscle.
    C) Chronic ischemia in previously healthy tissue results in less severe consequences than in compromised tissue.
    D) Ischemia affects all tissues equally regardless of their metabolic demands.
    Answer: C
12. **What is the primary biochemical consequence of hypoxia on cellular function?**
    A) Increased ATP production through anaerobic glycolysis.
    B) Failure of oxidative phosphorylation leading to ATP depletion.
    C) Enhanced protein synthesis due to decreased demand for energy.
    D) Activation of apoptosis pathways independent of energy status.
    Answer: B
13. **In ischemia-reperfusion injury, the major contributor to cell damage upon restoration of blood flow is:**
    A) Decreased blood volume.
    B) Increased generation of reactive oxygen species (ROS).
    C) Elevated levels of lactate.
    D) Decreased nutrient availability.
    Answer: B

14. **Which type of cellular damage is associated with the accumulation of misfolded proteins?**
    A) Necrosis due to ATP depletion.
    B) Apoptosis via the mitochondrial pathway.
    C) Inflammation-mediated cell death.
    D) Hyperplasia of the endoplasmic reticulum.
    Answer: B
15. **Which of the following is NOT a direct effect of reactive oxygen species (ROS) on cellular structures?**
    A) Lipid peroxidation of membranes.
    B) Cross-linking and degradation of proteins.
    C) Induction of telomerase activity.
    D) Single strand breaks in DNA.
    Answer: C
16. **Acetaminophen toxicity primarily leads to liver injury through which mechanism?**
    A) Direct cytotoxicity from unchanged acetaminophen.
    B) Formation of reactive metabolites leading to oxidative stress.
    C) Impaired uptake of glucose by hepatocytes.
    D) Increased synthesis of anti-inflammatory cytokines.
    Answer: B
17. **What role do chaperones play in the context of endoplasmic reticulum (ER) stress?**
    A) They degrade misfolded proteins.
    B) They facilitate the translation of new proteins.
    C) They control proper protein folding and prevent accumulation of misfolded proteins.
    D) They activate apoptosis in response to misfolded proteins.
    Answer: C
18. **Which of the following conditions would most likely lead to mitochondrial dysfunction?**
    A) Increased extracellular glucose levels.
    B) Exposure to ionizing radiation.
    C) High levels of circulating insulin.
    D) Enhanced mitochondrial biogenesis.
    Answer: B
19. **Which mechanism primarily mediates the inflammatory response to cell injury?**
    A) Inhibition of apoptosis.
    B) Recruitment of leukocytes and release of inflammatory mediators.
    C) Increased oxidative phosphorylation.
    D) Enhanced ATP production in surrounding tissues.
    Answer: B

20. **What is the role of p53 in response to DNA damage?**
    A) It promotes cell cycle progression to allow repair.
    B) It triggers immediate apoptosis regardless of repair capability.
    C) It activates genes that halt the cell cycle for repair processes.
    D) It enhances the expression of anti-apoptotic proteins.
    Answer: C
21. **A 65-year-old man with a history of coronary artery disease experiences severe chest pain. An ECG reveals ST-segment elevation. After 2 minutes of ischemia, he receives treatment to restore blood flow. What is the most likely outcome of this brief ischemic episode?**
    A) Myocardial infarction
    B) Reversible cell injury
    C) Necrosis
    D) Heart failure
    Answer: B
22. **A 70-year-old woman is diagnosed with atherosclerosis that has reduced her blood flow by 70%. She reports episodes of angina during exertion. How would her myocardial cells respond to this chronic ischemia compared to previously healthy cells?**
    A) They would show no adaptation to ischemia.
    B) They would sustain less damage due to collateral circulation.
    C) They would necrose immediately upon ischemia.
    D) They would regenerate fully after each ischemic episode.
    Answer: B
23. **A 50-year-old man presents with liver failure after taking an overdose of acetaminophen. Which mechanism is primarily responsible for the liver damage observed in this patient?**
    A) Direct cytotoxic effect of acetaminophen
    B) Formation of reactive metabolites leading to oxidative stress
    C) Decreased glucose metabolism
    D) Increased protein synthesis
    Answer: B
24. **Case 4: A 30-year-old female with type 2 diabetes experiences significant pancreatic stress, resulting in misfolded insulin proteins. What cellular mechanism is likely activated due to this stress?**
    A) Apoptosis via the mitochondrial pathway
    B) Enhanced protein synthesis to compensate
    C) Increased telomerase activity
    D) Induction of anti-inflammatory pathways
    Answer: A
25. **An elderly man undergoes surgery but develops ischemia-reperfusion injury after blood flow is restored. Which factor primarily contributes to the cell damage observed upon restoration of blood flow?**
    A) Reduced ATP levels

B) Increased generation of reactive oxygen species (ROS)
C) Elevated levels of lactic acid
D) Decreased blood volume
Answer: B

26. **A 45-year-old woman with a severe viral infection develops widespread inflammation. What is the primary role of inflammatory cells in response to her condition?**
A) They inhibit apoptosis in affected tissues.
B) They secrete enzymes and substances that damage both pathogens and host tissues.
C) They enhance mitochondrial function.
D) They promote cellular regeneration.
Answer: B

27. **A 55-year-old man is exposed to high levels of radiation during a work incident. What is the most likely consequence of this exposure on his cells?**
A) Increased protein synthesis
B) Mitochondrial dysfunction leading to energy depletion
C) Enhanced telomere repair
D) Decreased oxidative stress
Answer: B

28. **A child is diagnosed with cystic fibrosis due to a genetic mutation affecting protein folding. What cellular mechanism contributes to the pathology seen in this condition?**
A) Increased apoptosis from misfolded proteins
B) Enhanced autophagy
C) Reduced oxidative phosphorylation
D) Mitochondrial biogenesis
Answer: A

29. **A 62-year-old man with a long history of smoking develops lung cancer. He is treated with chemotherapy, which leads to significant toxicity and cellular damage in his liver. Which of the following mechanisms is primarily responsible for the liver damage in this case?**
A) Direct action of chemotherapy on liver cells
B) Metabolism of the drug into reactive metabolites
C) Ischemia due to reduced blood supply
D) Increased insulin resistance
Answer: B

30. **A 25-year-old athlete experiences muscle cramping and pain after an intense workout. Blood tests reveal elevated levels of lactic acid and decreased pH. What physiological change has most likely occurred in his muscle cells due to intense exercise?**
A) Increased oxidative phosphorylation

B) Activation of anaerobic glycolysis
C) Enhanced ATP production
D) Apoptosis of muscle cells
Answer: B

31. **Case 11: A 50-year-old woman with chronic kidney disease is found to have elevated levels of reactive oxygen species (ROS) in her blood. What is a likely consequence of this increase in ROS in her body?**
A) Decreased lipid peroxidation
B) DNA damage and mutations
C) Enhanced mitochondrial function
D) Increased protein synthesis
Answer: B
32. **A 40-year-old male presents with muscle weakness and atrophy. A biopsy reveals a high number of misfolded proteins within the cells. What cellular process is likely failing in this patient, leading to the accumulation of misfolded proteins?**
A) Protein synthesis
B) Ubiquitin-proteasome pathway
C) Glycolysis
D) Lipid metabolism
Answer: B
33. **A 70-year-old woman suffers a stroke, leading to a period of ischemia in the brain. After restoration of blood flow, she experiences additional neuronal damage. What phenomenon is most likely occurring in her brain cells after reperfusion?**
A) Enhanced ATP production
B) Ischemic preconditioning
C) Ischemia-reperfusion injury
D) Decreased oxidative stress
Answer: C
34. **A laboratory experiment exposes cultured cells to high levels of oxidative stress, leading to the generation of ROS. What is one of the immediate cellular effects of excessive ROS on these cells?**
A) Increased ribosome production
B) Lipid peroxidation of cellular membranes
C) Enhanced glucose uptake
D) Activation of the cell cycle
Answer: B
35. **A 35-year-old woman diagnosed with a genetic disorder shows severe misfolding of proteins, leading to a condition known as amyloidosis. What is a significant consequence of protein misfolding in her case?**
A) Decreased apoptosis of affected cells
B) Accumulation of amyloid fibrils in tissues
C) Enhanced immune response

D) Increased production of chaperone proteins

Answer: B

36. **A 35-year-old male experiences severe blood loss due to a ruptured spleen after an accident. During transport to the hospital, he exhibits signs of shock. Which of the following tissues is most likely to tolerate hypoperfusion with the least injury?**

A) Cardiac Muscle

B) Liver

C) Renal Cortex

D) Skin

E) Intestinal Mucosa

Answer: B

37. **A 60-year-old female undergoes a coronary angioplasty after an acute myocardial infarction. Despite successful revascularization, she develops reperfusion injury. Which of the following mechanisms is most likely responsible for the worsening of myocardial damage?**

A) Decreased ATP production

B) Increased intracellular calcium

C) Increased production of reactive oxygen species

D) Mitochondrial biogenesis

E) Decreased oxidative stress

Answer: C

38. **In a laboratory study, cells are exposed to high levels of oxidative stress. To counteract the damaging effects of free radicals, the cells increase the synthesis of which of the following protective enzymes?**

A) Superoxide Dismutase

B) Cyclooxygenase

C) Aldose Reductase

D) Protein Kinase

E) DNA Polymerase

Answer: A

39. **A genetic mutation leads to the accumulation of misfolded proteins within a cell, triggering cellular stress. Which of the following pathways is most likely activated in response to this accumulation?**

A) Apoptotic pathway

B) Autophagy pathway

C) Glycolytic pathway

D) Lipolysis pathway

E) Nucleotide synthesis pathway

Answer: B

STEP 1 Q :

A 74-year-old woman comes to the emergency department due to 2 days of left leg pain and numbness.She has a history of atrial fibrillation and hypertension. Her left lower limb is pale and cold to palpation below the knee. Arterial Doppler ultrasound shows an occluding thrombus, and a left femoral embolectomy is performed. Post-procedure dorsalis pedis and posterior tibial pulses become palpable. Several hours later, the patient begins to experience severe left calf pain. On repeat examination, the left calf is swollen, tense, and tender, and the pain worsens with dorsiflexion of the left foot. The distal pulses are also absent. The physician suspects injury of the reperfused muscles in part due to overproduction of reactive oxygen species. Which of the following enzymes is most likely to help neutralize these toxic molecules?

A Cytochrome oxidase
B Cytochrome P450
C Myeloperoxidase
D NADPH oxidase
E Superoxide dismutase
ANSWER: E

As an antioxidant, superoxide dismutase neutralizes reactive oxygen species, preventing cell injury. In a pathologic state such as post-ischemic reperfusion, oxidative stress is high and reactive oxygen species production exceeds the neutralizing capability of antioxidants, leading to increased cell damage and death.

A 64-year-old man develops diarrhea, abdominal pain, nausea, vomiting, and anorexia 3 weeks after starting radiation therapy for prostate cancer. Physical examination shows abdominal tenderness. Sigmoidoscopy reveals hyperemia, edema, erosion, and ulceration of the intestinal mucosa. Stool and serum chemistries are normal. Radiation enteritis is suspected. Which of the following is most likely the primary mechanism responsible for this patient's intestinal changes?

A Generation of reactive oxygen species
B Increased activity of the ubiquitin-proteasome system
C Inhibition of DNA polymerase
D Inhibition of thymidylate synthesis
E Prevention of microtubule assembly
ANSWER: A

Ionizing radiation causes cellular and DNA damage primarily through generation of reactive oxygen species, which can trigger progressive inflammation and tissue damage. In the gastrointestinal tract, the acute effects of radiation exposure typically occur several weeks after radiotherapy is initiated and manifest as abdominal pain and diarrhea due to mucosal denudation, inflammation, and edema.

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