

## Cell injury

- **Multiple Choices, Test Bank questions**

وَمَنْ يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ

## بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

A 50-year-old chronic alcoholic presents to the emergency room with 12 hours of severe abdominal pain. The pain radiates to the back and is associated with an urge to vomit. Physical examination discloses exquisite abdominal tenderness. Laboratory studies show elevated serum amylase. Which of the following morphologic changes would be expected in the peripancreatic tissue of this patient?

- (A) Coagulative necrosis
- (B) Caseous necrosis
- (C) Fat necrosis
- (D) Fibrinoid necrosis
- (E) Liquefactive necrosis

### Note: a hint for the question

Serum amylase is an enzyme produced by the pancreas that helps in the digestion of carbohydrates. Elevated levels in the blood may indicate pancreatic or salivary gland issues.

### The answer

**The answer is C: Fat necrosis.** Saponification of fat derived from peripancreatic fat cells exposed to pancreatic enzymes is a typical feature of fat necrosis. Lipase, released from pancreatic acinar cells during an attack of acute pancreatitis, hydrolyzes fat into fatty acids and glycerol. Free fatty acids bind with calcium to form soaps, which is a process known as saponification. Entry of calcium ions into the injured tissue reduces the level of calcium in blood. Hypocalcemia is, therefore, a typical finding in patients who had a recent bout of acute pancreatitis. Patients with acute pancreatitis experience sudden-onset abdominal pain, distention, and vomiting. The other choices are not typically seen in peripancreatic tissue following acute pancreatitis, although liquefactive necrosis (choice E) may be observed.

**Diagnosis:** Acute pancreatitis

A 75-year-old woman with Alzheimer disease dies of congestive heart failure. The brain at autopsy is shown in the image. This patient's brain exemplifies which of the following responses to chronic injury?



- (A) Anaplasia
- (B) Atrophy
- (C) Dysplasia
- (D) Hyperplasia
- (E) Hypertrophy

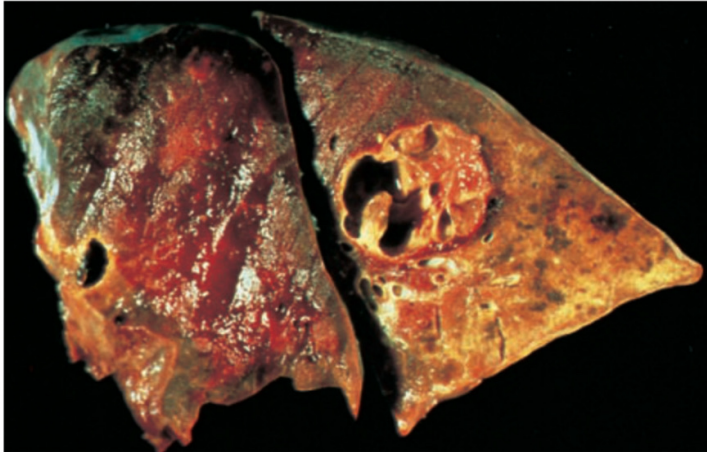
→ **loss of brain tissue and a decrease in overall brain size.**

### The answer

**The answer is B: Atrophy.** Clinically, atrophy is recognized as diminution in the size or function of an organ. It is often seen in areas of vascular insufficiency or chronic inflammation and may result from disuse. Atrophy may be thought of as an adaptive response to stress, in which the cell shuts down its differentiated functions. Reduction in the size of an organ may reflect reversible cell atrophy or may be caused by irreversible loss of cells. For example, atrophy of the brain in this patient with Alzheimer disease is secondary to extensive cell death, and the size of the organ cannot be restored. This patient's brain shows marked atrophy of the frontal lobe. The gyri are thinned, and sulci are widened. Anaplasia (choice A) represents lack of differentiated features in a neoplasm.

**Diagnosis:** Alzheimer disease, atrophy

A 59-year-old female alcoholic is brought to the emergency room with a fever (38.7°C/103°F) and foul-smelling breath. The patient subsequently develops acute bronchopneumonia and dies of respiratory insufficiency. A pulmonary abscess is identified at autopsy (shown in the image). Histologic examination of the wall of this lesion would most likely demonstrate which of the following pathologic changes?



- (A) Caseous necrosis
- (B) Coagulative necrosis
- (C) Fat necrosis
- (D) Fibrinoid necrosis
- (E) Liquefactive necrosis

### **The answer**

**The answer is E: Liquefactive necrosis.** When the rate of dissolution of the necrotic cells is faster than the rate of repair, the resulting morphologic appearance is termed liquefactive necrosis. The polymorphonuclear leukocytes of the acute inflammatory reaction are endowed with potent hydrolases that are capable of digesting dead cells. A sharply localized collection of these acute inflammatory cells in response to a bacterial infection produces rapid death and dissolution of tissue. The result is often an abscess defined as a cavity formed by liquefactive necrosis in a solid tissue. Caseous necrosis (choice A) is seen in necrotizing granulomas. In coagulative necrosis (choice B), the outline of the cell is retained. Fat (choice C) is not present in the lung parenchyma. Fibrinoid necrosis (choice D) is seen in patients with necrotizing vasculitis.

**Diagnosis:** Pulmonary abscess, liquefactive necrosis

A 52-year-old woman loses her right kidney following an automobile accident. A CT scan of the abdomen 2 years later shows marked enlargement of the left kidney. The renal enlargement is an example of which of the following adaptations?

- (A) Atrophy
- (B) Dysplasia
- (C) Hyperplasia
- (D) Hypertrophy
- (E) Metaplasia

### **The answer**

**The answer is D: Hypertrophy.** Hypertrophy is a response to trophic signals or increased functional demand and is commonly a normal process. For example, if one kidney is rendered inoperative because of vascular occlusion, the contralateral kidney hypertrophies to accommodate increased demand. The molecular basis of hypertrophy reflects increased expression of growth-promoting genes (protooncogenes) such as *myc*, *fos*, and *ras*. Hyperplasia (choice C) of renal tubular cells may occur, but enlargement of the kidney in this patient is best referred to as hypertrophy (i.e., increased organ size and function).

**Diagnosis:** Hypertrophy

A 60-year-old man with chronic cystitis complains of urinary frequency and pelvic discomfort. Digital rectal examination is unremarkable. Biopsy of the bladder mucosa reveals foci of glandular epithelium and chronic inflammatory cells. No cytologic signs of atypia or malignancy are observed. Which of the following terms best describes the morphologic response to chronic injury in this patient?

- (A) Atrophy
- (B) Dysplasia
- (C) Hyperplasia
- (D) Hypertrophy
- (E) Metaplasia

### **The answer**

**The answer is E: Metaplasia.** Metaplasia of transitional epithelium to glandular epithelium is seen in patients with chronic inflammation of the bladder (cystitis glandularis). Metaplasia is considered to be a protective mechanism, but it is not necessarily a harmless process. For example, squamous metaplasia in a bronchus may protect against injury produced by tobacco smoke, but it also impairs the production of mucus and ciliary clearance of debris. Furthermore, neoplastic transformation may occur in metaplastic epithelium. Lack of cytologic evidence for atypia and neoplasia rules out dysplasia (choice B).

**Diagnosis:** Chronic cystitis, metaplasia



A 77-year-old woman has chronic renal failure. Her serum urea nitrogen is 40 mg/dL. She is given a diuretic medication and loses 2 kg (4.4 lb). She reduces the protein in her diet and her serum urea nitrogen decreases to 30 mg/dL. Which of the following terms best describes cellular responses to disease and treatment in this woman?

- A Adaptation
- B Apoptosis
- C Necroptosis
- D Irreversible injury
- E Metabolic derangement

### The answer

**1 A** Normal cells handle physiologic demands and maintain metabolic functions within narrow ranges, termed *homeostasis*. Under disease conditions with stress on cells, there is adaptation to a new steady state. In this case, the loss of renal function leads to a higher urea nitrogen level as well as retention of fluid. The diuretic induces loss of the excess fluid to yield a new steady state. The protein restriction reduces urea nitrogen excretion, which also leads to a new steady state. Both are adaptations. Apoptosis refers to single cell necrosis in response to injury. An irreversible injury leads to cell death, but the changes described here are not evidence for cellular necrosis. The metabolism of cells is maintained for adaptation, with response to the diuretic and to protein restriction.

2 A 53-year-old woman with no prior illnesses has a routine checkup by her physician. On examination she has a blood pressure of 150/95 mm Hg. If her hypertension remains untreated for years, which of the following cellular alterations would most likely be seen in her myocardium?

- A Apoptosis
- B Dysplasia
- C Fatty change
- D Hemosiderosis
- E Hyperplasia
- F Hypertrophy
- G Metaplasia

→ Normal BP=120/80

### The answer

**2 F** The pressure load on the left ventricle results in an increase in myofilaments in the existing myofibers, so they enlarge. The result of continued stress from hypertension is eventual heart failure with decreased contractility. Apoptosis would lead to loss of cells and diminished size. Dysplasia is not a diagnosis made for the heart. Hemosiderin deposition in the heart is a pathologic process resulting from increased iron stores in the body. Though hyperplasia from proliferation of myofibroblasts is possible, this does not contribute significantly to cardiac size. Metaplasia of muscle does not occur, although loss of muscle occurs with aging and ischemia as myofibers are replaced by fibrous tissue.



**Which of the following is a key feature of apoptosis?**

- a) Cellular proliferation**
- b) Cell swelling**
- c) Cell shrinkage and fragmentation**
- d) Increased cell size**

**Answer: c) Cell shrinkage and fragmentation**

**What is the role of caspases in apoptosis?**

- a) DNA repair**
- b) Cell adhesion**
- c) Initiating and executing apoptosis**
- d) Energy production**

**Answer: c) Initiating and executing apoptosis**

**Which organelle is often involved in the initiation of the intrinsic apoptotic pathway?**

- a) Golgi apparatus**
- b) Endoplasmic reticulum**
- c) Mitochondria**
- d) Nucleus**

**Answer: c) Mitochondria**

**Which of the following is a characteristic feature of necrosis?**

- a) Cell shrinkage**
- b) Membrane blebbing**
- c) Controlled fragmentation**
- d) Energy-dependent process**

**Answer: b) Membrane blebbing**

**Which type of necrosis is associated with severe bacterial infections?**

- a) Coagulative necrosis**
- b) Liquefactive necrosis**
- c) Caseous necrosis**
- d) Fat necrosis**

**Answer: c) Caseous necrosis**

**→ Remember TB**

**What characterizes necrotic cell morphology?**

- a) Cell shrinkage**
- b) Controlled fragmentation**
- c) Swelling and organelle breakdown**
- d) Chromatin condensation**

**Answer: c) Swelling and organelle breakdown**



**What distinguishes apoptosis from necrosis?**

- a) Inflammation is present in apoptosis**
- b) Apoptosis is always pathological**
- c) Cellular contents are released in apoptosis**
- d) Programmed nature of apoptosis**

**Answer: d) Programmed nature of apoptosis**

**What is the primary characteristic of coagulative necrosis?**

- a) Cellular swelling**
- b) Cell liquefaction**
- c) Preservation of tissue architecture**
- d) Fibrinoid deposition**

**Answer: c) Preservation of tissue architecture**

**Which type of necrosis is commonly associated with tuberculosis?**

- a) Liquefactive necrosis**
- b) Caseous necrosis**
- c) Fat necrosis**
- d) Fibrinoid necrosis**

**Answer: b) Caseous necrosis**

**In which organ is fat necrosis commonly observed?**

- A) Liver**
- B) Pancreas**
- C) Kidneys**
- D) Heart**

**Answer: B) Pancreas**

**In which of the following conditions does caseous necrosis commonly occur?**

- A) Ischemic injury**
- B) Tuberculosis**
- C) Pancreatitis**
- D) Burn injury**

**Answer: B) Tuberculosis**

**Fat necrosis is often associated with damage to which type of tissue?**

- A) Neural tissue**
- B) Adipose tissue**
- C) Cardiac tissue**
- D) Bone tissue**

**Answer: B) Adipose tissue**



**Which of the following is an anti-apoptotic protein?**

- a) Bax**
- b) Bcl-2**
- c) Caspase-3**
- d) Fas ligand**

**Answer: b) Bcl-2**

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ:

فَنَادَى فِي الظُّلُمَاتِ أَن لَّا إِلَهَ إِلَّا أَنْتَ سُبْحَانَكَ إِنِّي  
كُنْتُ مِنَ الظَّالِمِينَ ﴿٨٧﴾ فَاسْتَجَبْنَا لَهُ وَنَجَّيْنَاهُ  
مِنَ الْغَمِّ وَكَذَلِكَ نُنَجِّي الْمُؤْمِنِينَ ﴿٨٨﴾ وَزَكَرِيَّا

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ:

﴿٣٨﴾ وَأَن لَّيْسَ لِلإِنسَانِ إِلَّا مَا سَعَى ﴿٣٩﴾ وَأَن سَعِيَهِ وَسَوْفَ يُرَى  
﴿٤٠﴾ ثُمَّ يُجْزَاهُ الْجَزَاءَ الْأَوْفَى ﴿٤١﴾ وَأَن إِلَى رَبِّكَ الْمُنْتَهَى ﴿٤٢﴾  
وَأَنَّهُ هُوَ أَضْحَكَ وَأَبْكَى ﴿٤٣﴾ وَأَنَّهُ هُوَ أَمَاتَ وَأَحْيَا ﴿٤٤﴾