DE GRUYTER

Steven C. Kazmierczak and Hassan M. E. Azzazy (Eds.)

DIAGNOSTIC ENZYMOLOGY

Questions and Answers

Chapter 1 - Angiotensin Converting Enzyme

Joe M. El-Khoury, Edmunds Reineks and Sihe Wang

1. Through which pathway does ACE play a role in blood pressure regulation? (Answer e)
    a. Angiotensin I production
    b. Angiotensin II production
    c. Bradykinin inactivation
    d. Angiotensin I production and bradykinin inactivation
    e. Angiotensin II production and bradykinin inactivation
2. Which statement is false about the two isoforms of ACE (sACE and tACE)? (Answer c)
    a. They are derived from a common gene by alternative splicing
    b. The somatic isoform (sACE) is larger than tACE
    c. tACE is almost identical with the N domain of sACE
    d. The crystal structure of tACE was revealed first in 2003
    e. Both isoforms are heavily glycosylated
3. What does ACE require to maintain maximum activity? (Answer d)
    a. Chloride
    b. Zinc
    c. Vitamin B6
    d. Zinc and Chloride
    e. Zinc and Vitamin B6
4. What factor limits the utility of ACE reference ranges? (Answer b)
    a. Serum ACE activity is largely independent of age, gender or race
    b. Genetic polymorphism
    c. Chloride-dependent activation
    d. Discovery of ACE2
    e. Poor clinical sensitivity
5. What is the most likely source of elevated serum ACE activity in sarcoidosis? (Answer a)
    a. Epithelioid cells originating from macrophages
    b. Lungs
    c. Kidneys
    d. Hepatic cells
    e. Intestines

6. What may cause elevated levels of ACE activity? (Answer e)
    a. Sarcoidosis
    b. Neurosarcoidosis
    c. Tuberculosis
    d. Gaucher's disease
    e. All of the above
7. Which specimen is unacceptable for the measurement of ACE activity? (Answer d)
    a. Cerebrospinal fluid
    b. Serum separator tube
    c. Heparinized plasma
    d. EDTA plasma
    e. Plain serum tube
8. What are the most widely adopted methods for the measurement of ACE in clinical labs? (Answer a)
    a. Spectrophotometric methods
    b. High-performance liquid chromatography methods
    c. Fluorometric methods
    d. Radioassays
    e. Capillary electrophoresis

Chapter 2 - Acetylcholinesterase and Butyrylcholinesterase

Peter L. Platteborze

1. What is the proposed physiological function of BChE? (Answer d)
    a. Critical role in neurotransmission
    b. Serve as a reservoir for essential amino acids
    c. Activates the complement system
    d. Bind compounds that inhibit AChE
    e. Serve as a carrier protein for fatty acids and certain hormones
2. Which statement is false regarding the diagnostic use of BChE and/or AChE? (Answer b)
    a. Used to monitor exposure to toxic organophosphate compounds
    b. BChE activity is commonly used in the U.S. to diagnose liver disease
    c. The presence of AChE in amniotic fluid can be used to diagnose fetal neural tube defects
    d. Used to monitor exposure to toxic carbamate compounds
    e. Dibucaine inhibition can identify individuals with BChE variants that are unable to efficiently hydrolyze succinylcholine

3. Which of the following statements is true? (Answer d)
    a. Serum BChE activity is primarily used to monitor for chronic poisoning
    b. RBC-AChE activity is primarily used to monitor for acute poisoning
    c. BChE activity is a surrogate marker for *in vivo* neurotoxicity
    d. Exposure to anticholinesterase compounds generally results in BChE activity declining more rapidly than AChE activity
    e. Both AChE and BChE assays are commonly used in hospitals
4. What would you expect to occur in patients who are homozygous for atypical BChE after exposure to succinylcholine? (Answer b)
    a. Prolonged apnea of more than 2 hours; Dibucaine number more than 70
    b. Prolonged apnea of more than 2 hours; Dibucaine number less than 20
    c. Prolonged apnea of more than 2 hours; Dibucaine number less than 70
    d. Normal response; Dibucaine number less than 70
    e. Slightly prolonged apnea; Dibucaine number between 40 and 70
5. What is the primary clinical use for measuring ChE activity? (Answer. e)
    a. Forensics
    b. Pretesting of patients to ensure a normal response to succinylcholine or mivacurium
    c. Assess fetal neural tube defects
    d. Assess liver function
    e. Identify exposures to dangerous pesticides or chemical warfare agents
6. Which of the following statements is true about carbamate poisonings? (Answer a)
    a. Are less severe and of shorter duration than organophosphate poisonings
    b. Result in the irreversible inhibition of the cholinesterases in a process called aging
    c. Duration of symptoms is usually longer than 24 hours
    d. Sarin and soman are examples of carbamates
    e. Are more severe and of shorter duration than organophosphate poisonings
7. Which of the following is NOT a common symptom of anticholinesterase poisoning? (Answer. e)
    a. Miosis
    b. Urinary incontinence
    c. Lacrimation
    d. Defecation
    e. Mydriasis
8. Which of the following statements is true regarding cholinesterase lab testing? (Answer b)
    a. BChE has a narrower reference range than AChE
    b. Serum BChE is often used to monitor acute poisoning
    c. AChE is easier to measure so is more commonly used at hospitals
    d. BChE is a surrogate marker for *in vivo* neurotoxicity
    e. RBC-AChE is used to assess acute poisoning

9. What is the most commonly used lab assay to measure cholinesterase activity? (Answer c)
    a. Immunoassay
    b. Delta pH method
    c. Ellman method
    d. Radiolabelled microassay
    e. Jaffe method

Chapter 3 – Aldolase

Sihe Wang

1. Serum aldolase is typically highest in which of the following groups? (Answer a)
    a. healthy infants
    b. adult males
    c. adult females
    d. post-menopausal females
    e. geriatric patients
2. Which of the following enzymes has supplanted aldolase as a diagnostic tool? (Answer d)
    a. LD
    b. AST
    c. ALT
    d. CK
    e. ALP

Chapter 4 - Alkaline Phosphatase (ALP)

Amy E. Schmidt

1. Which of the following ALP isoenzymes retains activity following heating for 10 minutes as 65 ^{o}C? (Answer a)
    a. Regan
    b. Liver
    c. Bone
    d. Intestinal
    e. Prostate
2. Which of the following conditions results in the greatest increase in serum ALP activity? (Answer d)
    a. Pregnancy
    b. Rickets
    c. Liver cirrhosis
    d. Paget’s disease

e. Osteomalacia

3. Which ALP isoenzyme exhibits the shortest half life? (Answer e)
    a. Placental ALP
    b. Bone ALP, with a half-life of 12 hours
    c. Regan isoenzyme
    d. Intestinal ALP with a half life of 8 hours
    e. Intestinal ALP with a half life of less than 30 minutes
4. Which of the following is required for ALP activity? (Answer b)
    a. Ca^{+2}
    b. Zn^{+2}
    c. NADH
    d. NAD^{+}
    e. PO_4^{++}
5. Which of the following ALP isoenzymes is most readily deactivated by heating at 65^{o}C ? (Answer c)
    a. Intestinal
    b. Liver
    c. Bone
    d. Regan
    e. Placental

Chaper 5 - Aspartate Aminotransferase and Alanine Aminotransferase

Joe M. El-Khoury and Sihe Wang

1. AST requires what as a co-factor? (Answer c)
    a. Magnesium
    b. Vitamin B_3
    c. Vitamin B_6
    d. Calcium
    e. Vitamin B_{12}
2. Where is AST located intracellularly? (Answer d)
    a. Cytoplasm
    b. Nucleus
    c. Mitochondria
    d. Cytoplasm and Mitochondria
    e. Cytoplasm and Nucleus
3. Which statement is false about c-AST and m-AST? (Answer d)
    a. Both c-AST and m-AST have a homodimeric structure composed of two identical polypeptides subunits
    b. m-AST is synthesized as a precursor first, while c-AST has no known precursor

c. There are multiple subforms of c-AST identified, but only one form of m-AST
d. The holoenzyme of m-AST has a larger molecular weight than c-AST
e. m-AST has a longer serum activity half life after myocardial infarction than c-AST

4. A persistently elevated level of AST in asymptomatic patients is suggestive of what condition? (Answer b)
    a. Myocardial Infarction
    b. Macro-AST
    c. Ischemic or toxic liver injury
    d. Rhabdomyolysis
    e. Renal failure

5. In what tissues is AST predominantly located? (Answer e)
    a. Heart, lungs, skeletal muscle and kidneys
    b. Liver, lungs, skeletal muscle and kidneys
    c. Heart, liver, duodenum, and kidneys
    d. Liver, duodenum, skeletal muscle and kidneys
    e. Heart, liver, skeletal muscle and kidneys

6. What is the most common cause for elevated AST? (Answer a)
    a. Ischemic or toxic liver injury
    b. Myocardial Infarction
    c. Rhabdomyolysis
    d. Viral hepatitis
    e. Autoimmune hepatitis

7. How is AST measured? (Answer c)
    a. By spectrophotometrically monitoring the rate of disappearance of NAD^+
    b. By spectrophotometrically monitoring the rate of appearance of malate
    c. By spectrophotometrically monitoring the rate of disappearance of NADH
    d. By spectrophotometrically monitoring the rate of disappearance of oxaloacetate
    e. By spectrophotometrically monitoring the rate of appearance of NAD^+

8. How did the IFCC attempt to improve inter-laboratory variation for AST? (Answer e)
    a. Establish recommended procedures
    b. Establish a primary reference measurement procedure
    c. Publish procedural notes and useful advice
    d. Develop certified reference materials
    e. All of the above

Chapter 7 - Creatine kinase, isoenzymes and isoforms

Alan H.B. Wu

1. The predominant form of CK found in the fetus is. (Answer c)
    a. CK-MM

b. CK-MB
c. CK-BB
d. Macro CK type 1
e. Macro CK type 2

2. The clinical significance of macro CK type 1 is. (Answer d)
   a. Strong association with myocardial infarction
   b. Strong association with risk of cardiovascular disease
   c. Strong association with risk of stroke
   d. No clinical significance
   e. Strong association with diabetes

3. The CK isoform produced in tissue is termed. (Answer b)
   a. CKMM
   b. $CKMM_3$
   c. $CKMM_2$
   d. $CKMM_1$
   e. $CKMB_1$

4. Which of the following is the first to appear in serum following an AMI? (Answer b)
   a. CKBB
   b. $CKMM_3$
   c. $CKMM_2$
   d. $CKMM_1$
   e. $CKMB_1$

5. Which of the following is used to stabilize magnesium in assays used to measure CK activity? (Answer a)
   a. magnesium
   b. creatine
   c. NADPH
   d. cysteine
   e. carboxypeptidase N

Chapter 8 - Gamma-Glutamyl Transferase

Sarah M. Brown

1. Which of the following do not contain high activities of GGT? (Answer e)
   a. proximal renal tubule cells
   b. hepatic canaliculi
   c. intestinal brush border cells.
   d. biliary epithelial cells
   e. renal parenchymal cells

2. Which of the following organs contain the highest GGT activity per gram of tissue? (Answer a)
    a. kidney
    b. liver
    c. pancreas
    d. intestine
    e. brain
3. A two-fold increase in serum GGT activity would most likely been seen in which of the following. (Answer a)
    a. viral hepatitis
    b. drug-induced intrahepatic cholestasis
    c. biliary cirrhosis
    d. extrahepatic biliary obstruction due to gallstones
    e. osetomalacia
4. Urine GGT activities are highest in which of the following conditions. (Answer a)
    a. pyelonephritis
    b. acute pancreatitis
    c. viral hepatitis
    d. intrahepatic bilirary obstruction
    e. biliary cirrhosis

Chapter 9 - Lactate Dehydrogenase (LD)

Olajumoke Oladipo and Dennis J. Dietzen

1. LD found in normal serum is derived primarily from which of the following? (Answer a)
    a. Erythrocytes and platelets
    b. Liver
    c. Skeletal muscle
    d. Myocardium
    e. Kidney
2. The enzymatic function of LD is to catalyze which of the following? (Answer b)
    a. Phosphorylation of lactate during glycolysis
    b. Reduction of pyruvate to lactate to regenerate NAD
    c. Reduction of pyruvate to lactate to regenerate NADH
    d. Reduction of lactate of pyruvate to regenerate NAD
    e. Reduction of pyruvate to lactate to regenerate NADH
3. Which of the following disorders is associated with the highest serum LD activities? (Answer c)
    a. Acute myocardial infarction
    b. Renal infarction

c. Acute lymphocytic leukemia
d. Viral hepatitis
e. Alcoholic hepatitis

4. Which of the following disorders is typically associated with an increase in the LD_1 isoenzyme. (Answer e)
    a. Skeletal muscle injury
    b. Hepatitis
    c. Pulmonary infarction
    d. Orthotopic liver transplantation
    e. Testicular seminoma

5. Which of the following would likely be seen in an exudative effusion? (Answer b)
    a. No measurable LD activity
    b. A fluid-to-serum LD ratio of 0.6 or greater
    c. Fluid LD activity that is less than 200 u/L
    d. Fluid LD activity that is at least 2 fold greater than serum CK activity
    e. Fluid LD activity that is at least 2 fold greater than serum glucose concentrations

6. Which of the following statements is correct? (Answer c)
    a. Serum LD activity is higher than plasma LD due to inhibition of LD by heparin
    b. Serum LD activity is lower than plasma LD due to uptake of LD by erythrocytes during clotting
    c. Serum LD activity is higher than plasma LD due to release of LD from platelets during clotting.
    d. Serum LD activity is lower than plasma due to degradation of LD by platelets activated during the process of clotting
    e. Serum LD activity is lower than plasma due to heparin-induced release of LD from erythrocytes

Chapter10 - Pancreatic Lipase

Wan-Ming Zhang, Edmunds Reineks, Joe M. El-Khoury and Sihe Wang

1. Human serum lipases are mainly derived from which tissue? (Answer. c)
    a. Renal
    b. Duodenum
    c. Pancreas
    d. Hepatic
    e. Ileum

2. Lipase requires which as a cofactor? (Answer d)
    a. Zinc
    b. Chloride
    c. Vitamin B6

d. Colipase
e. Vitamin B12

3. What structural feature of lipase provides it with high selectivity towards hydrolyzing triglycerides? (Answer d)
    a. The β-sandwich structure of the C-domain
    b. The α/ β-hydrolase fold of the N-domain
    c. The N-terminal residues Ser 153, Asp 177 and His 263 that form the catalytic site
    d. The lid domain
    e. All of the above
4. All of the following lipases exist EXCEPT? (Answer e)
    a. Bile salt dependent lipases
    b. Hepatic lipase
    c. Lipoprotein lipase
    d. Hormone-sensitive lipase
    e. Adrenal lipase
5. Measurement of serum lipase is helpful in all of the following conditions except? (Answer b)
    a. Acute pancreatitis
    b. Liver failure
    c. Pancreatic cancer
    d. Cystic fibrosis
    e. Renal failure
6. Which of the following specimens is unacceptable for the measurement of serum lipase activity? (Answer b)
    a. Serum separator
    b. EDTA plasma
    c. Plain serum
    d. Sodium heparin
    e. Lithium heparin
7. What methods have not been developed for the measurement of serum lipase activity? (Answer e)
    a. Turbidimetric
    b. pH-stat
    c. Colorimetric and fluorometric
    d. Immunochemical
    e. High-performance liquid chromatography