

USMLE-STEP-1^{Q&As}

United States Medical Licensing Step 1

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QUESTION 1

Loss of the hepatic protein hepcidin can lead to severe iron overload with symptoms resembling those of hemochromatosis. Which of the following functions of hepcidin accounts for the iron overload when the protein is deficient?

A. activates the expression of the ironresponse element-binding protein that regulates transferring receptor and ferritin mRNA translation

- B. decreases the level of intestinal membrane iron transporters, resulting in reduced iron uptake
- C. facilitation of the interaction of transferring with the transferrin receptor
- D. forms a complex with ferritin allowing for higher intracellular storage

E. promotes the formation of hemosiderin, thus detoxifying iron

Correct Answer: B

Section: Biochemistry Hepcidin is a hepatically synthesized iron regulatory protein that functions by inhibiting the presentation of one or more of the iron transporters [e.g., DMT1 and Ireg1 (ferroportin)] in intestinal membranes. With a high iron diet, the level of hepcidin mRNA increases and conversely its levels decrease when dietary iron is low. This is occurring simultaneous to reciprocal changes in the levels of the transporters proteins themselves. Loss of hepcidin activity would then lead to unregulated iron uptake from the intestines leading to iron overload. In fact, it is now considered that defects in hepcidin function contribute to the development of hemochromatosis. Hepcidin does not activate expression of iron-response elementbinding protein (choice A), facilitate transferring interaction with the transferring receptor (choice C), form a complex with ferritin (choice D), nor promote the formation of hemosiderin (choice E).

QUESTION 2

Using laboratory micropuncture technique, blood plasma is collected from both the afferent arteriole and efferent arteriole of a renal cortical glomerulus. Which of the following has the lowest afferent/efferent arteriole concentration ratio?

- A. albumin
- B. chloride
- C. glucose
- D. potassium
- E. sodium

Correct Answer: A

Section: Physiology The process of glomerular ultrafiltration creates a tubular fluid that is essentially protein free. Hence, as plasma passes from the afferent arteriole, through the glomerular capillaries to the efferent arteriole, the protein albumin concentration rises as approximately 20% of the fluid is filtered out, leaving the albumin behind, giving an afferent/efferent arteriole concentration ratio of approximately 0.8. By contrast, the glomerular capillary membrane is freely permeable to water and other small particles such as glucose (choice A), chloride (choice B), potassium (choice D), and sodium (choice E), so their concentrations do not change as approximately 20% of water and solute are filtered



into Bowman\\'s capsule, giving afferent/ efferent arteriole concentration ratios of 1.0.

QUESTION 3

During development, the upper limb buds appear by day 27 and the lower limb buds by day 29. An apical ectodermal ridge at the tip of each limb bud promotes growth. This multilayered epithelial structure interacts with which of the following to direct the growth of the limb?

- A. ectoderm
- B. endoderm
- C. mesenchyme
- D. notochord
- E. sclerotome
- Correct Answer: C

Section: Anatomy The apical ectodermal ridge secretes fibroblast growth factors, which act on mesenchymal cells in the zone of polarizing activity at the posterior margin of the limb bud. Activation of the zone of polarizing activity causes expression of the sonic hedgehog gene. Proteins expressed by the sonic hedgehog gene control the anteroposterior developmental pattern of the limb. The apical ectodermal ridge is contained within the ectoderm (choice A) and has no interaction with the endoderm (choice B). The notochord (choice D) and sclerotome (choice E) are structures involved in the development of the axial skeleton and not the limbs.

QUESTION 4

During a routine pediatric visit, you discover a large abdominal mass in a 2-year-old boy. The mass is surgically removed and is illustrated in below figure. What is the most likely diagnosis?



A. abscess



- B. neuroblastoma
- C. renal cell carcinoma
- D. tuberculosis
- E. Wilms\\' tumor
- Correct Answer: E

Section: Pathology and Path physiology Figure shows a large tumor mass originating in the kidney. Wilms\\' tumor (or nephroblastoma) is the most common primary renal tumor of childhood and the second most common malignancy overall after lymphoma/ leukemia. It typically presents as a large abdominal mass discovered by a parent. An abscess (choice A) is a localized collection of pus that is not compatible with the solid mass shown here. A neuroblastoma (choice B) is most commonly primary in the adrenal and is unlikely to arise in the kidney. Renal cell carcinoma (choice C) is the most common primary renal tumor in adults, but is not expected in a child. Tuberculosis (choice D) would be identified by caseous necrosis, which has the appearance of amorphous crumbled cheese, not the solid appearance shown here.

QUESTION 5

A 67-year-old woman notices a lump in her left supraclavicular area. The lesion is excised and a section of it is shown in below figure. The microscopic appearance is most consistent with which of the following diagnoses?



- A. adenocarcinoma
- B. carcinoid
- C. fibroadenoma
- D. fibrosarcoma
- E. malignant fibrous histiocytoma

Correct Answer: A



Section: Pathology and Path physiology The finding of an enlarged left supraclavicular lymph node (Virchow or signal node) should raise the question of an underlying GI malignancy. This is confirmed in the above case by the microscopic findings in figure. The pleomorphism of these cells and the fact that they are located in a lymph node indicate that these are malignant cells. Additionally, the glandular appearance identifies this as an adenocarcinoma metastatic to a lymph node. Carcinoid tumors (choice B) arise from neuroendocrine cells present in the mucosa throughout the GI tract. About 40% are found in the appendix, where they are benign in 99% of cases. Another 25% are found in the ileum. Of these, about 60% are malignant. If they metastasize to the liver, they can give rise to the carcinoid syndrome. Fibroadenoma (choice C) is the most common benign tumor of the female breast. Fibrosarcoma (choice D) and malignant fibrous histiocytoma (choice E) are both fibroblastic sarcomas; the photomicrograph clearly indicates a malignancy of epithelial (glandular) origin.

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