

## Question 1.1

Serum LDL-cholesterol concentrations are measured in blood samples collected from 25 healthy volunteers. The data follow a normal distribution. The mean and standard deviation for this group are 130 mg/dL and 25 mg/dL, respectively. The standard error of the mean is 5.0. With a 95% confidence level, the true mean for the population from which this sample was drawn falls within which of the following ranges (in mg/dL)?

- (A) 105-155
- (B) 120-140
- (C) 125-135
- (D) 128-132
- (E) 129-131

### Correct Answer:

- (B) 120-140

### Neural Consult Response and Explanation:

**Answer:** B

**Explanation:** To determine the 95% confidence interval (CI) for the population mean, the formula is  $\text{Mean} \pm (\text{Z-score} * \text{Standard Error})$ . In medical statistics, for a 95% confidence level, the Z-score (critical value) is approximately 1.96 (often rounded to 2.0 for simplicity in clinical exams). The problem provides the mean (130 mg/dL) and the standard error of the mean (5.0 mg/dL). Calculating the interval:  $130 \pm (1.96 * 5.0) = 130 \pm 9.8$ , which results in a range of 120.2 to 139.8 mg/dL. Rounding to the nearest whole numbers provided in the options gives 120-140 mg/dL. Option A represents the range for 1 standard deviation from the mean (68% of the sample data, not the confidence interval of the mean). Option C uses a Z-score of 1.0. Options D and E are too narrow and do not reflect the correct application of the standard error in a 95% confidence interval calculation.

## Question 2.1

A 48-year-old man dies suddenly of a cardiac arrhythmia. Six weeks ago, he was resuscitated from a cardiac arrest caused by coronary artery disease and developed oliguric renal failure. Five weeks ago (1 week after being resuscitated), his serum urea nitrogen (BUN) concentration was 40 mg/dL, his serum creatinine concentration was 3.5 mg/dL, and his urine contained granular casts. Four weeks ago, his oliguria resolved, and his BUN and serum creatinine concentrations returned to normal. Examination of his kidneys at autopsy is most likely to show which of the following?

- (A) Acute inflammation
- (B) Fibrinous exudate
- (C) Fibrous scar
- (D) Granulation tissue



(E) Normal kidney

**Correct Answer:**

(E) Normal kidney

**Neural Consult Response and Explanation:**

**Answer:** E

**Explanation:** The patient experienced ischemic Acute Tubular Necrosis (ATN) following cardiac arrest. The clinical timeline shows a classic progression: an initial injury (6 weeks ago), a maintenance phase with oliguria and granular casts (5 weeks ago), and a recovery phase where renal function (BUN/Creatinine) normalized (4 weeks ago). Unlike many other tissues, the renal tubular epithelium has a high regenerative capacity. If the basement membrane remains intact (which is typical in ischemic ATN), the necrotic tubular cells are sloughed off (forming granular casts) and subsequently replaced by the proliferation of surviving tubular epithelial cells. By 4 weeks after the resolution of symptoms and normalization of laboratory values, the renal architecture typically returns to a histologically normal appearance. Options A and B (inflammation/exudate) describe the acute phase. Option D (granulation tissue) is a transient phase of repair not typically seen in the kidney in this manner. Option C (fibrous scar) would be expected if there were permanent cortical necrosis or chronic kidney disease, but the rapid and complete normalization of BUN and creatinine in a previously healthy individual points toward successful regeneration rather than replacement by scar tissue.

**Question 3.1**

In a sample of 100 individuals, the mean leukocyte count is  $7500/\text{mm}^3$ , with a standard deviation of  $1000/\text{mm}^3$ . If the leukocyte counts in this population follow a normal (gaussian) distribution, approximately 50% of individuals will have which of the following total leukocyte counts?

- (A)  $5500\text{--}9500/\text{mm}^3$
- (B)  $<6500/\text{mm}^3$  or  $>8500/\text{mm}^3$
- (C)  $6500\text{--}8500/\text{mm}^3$
- (D)  $<7500/\text{mm}^3$
- (E)  $>9500/\text{mm}^3$

**Correct Answer:**

(D)  $<7500/\text{mm}^3$

**Neural Consult Response and Explanation:**



**Answer: D**

**Explanation:** In a normal (Gaussian) distribution, the mean, median, and mode are all equal. By definition, a normal distribution is perfectly symmetrical around the mean. This means that exactly 50% of the values in the population lie below the mean, and exactly 50% of the values lie above the mean. Given a mean leukocyte count of  $7500/\text{mm}^3$ , approximately 50% of the individuals will have a count less than  $7500/\text{mm}^3$  (and 50% will have a count greater than  $7500/\text{mm}^3$ ). Option (A) represents approximately 95% of the population ( $\pm 2$  standard deviations). Option (C) represents approximately 68% of the population ( $\pm 1$  standard deviation). Option (E) represents approximately 2.5% of the population (values greater than 2 standard deviations above the mean). Option (B) represents the remaining 32% of the population outside of 1 standard deviation. Therefore, option (D) is the only mathematically precise description of 50% of a normal distribution based on the provided mean.

## Question 4.1

A 55-year-old woman comes to the clinic because of a 2-month history of increasingly severe vaginal pain and itching during sexual intercourse. She avoids intercourse with her husband because of the symptoms. She has been in a monogamous relationship with her husband for the past 25 years. She has type 2 diabetes mellitus. Her vital signs are within normal limits. Pelvic examination shows edematous and erythematous vaginal mucosa with white discharge. A photomicrograph of a vaginal smear is shown. Which of the following is the most likely causal infectious agent?

- (A) *Candida albicans*
- (B) *Chlamydia trachomatis*
- (C) Herpes simplex virus
- (D) Human papillomavirus
- (E) *Trichomonas vaginalis*

**Correct Answer:**

- (A) *Candida albicans*

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient's clinical presentation is classic for vulvovaginal candidiasis (VVC). Key features include vaginal pruritus (itching), dyspareunia (pain during intercourse), and physical exam findings of erythema, edema, and a thick white discharge. A critical risk factor in this patient is her history of type 2 diabetes mellitus; hyperglycemia increases vaginal glycogen levels, which promotes the overgrowth of *Candida* species. While the photomicrograph is not visible in the text, the diagnosis of *Candida* is confirmed by the presence of budding yeast and pseudohyphae on a KOH or saline wet mount. Other options are less likely: *Trichomonas vaginalis* (E) typically presents with a malodorous, thin, yellow-green frothy discharge and a 'strawberry cervix.' *Chlamydia trachomatis* (B) often causes cervicitis with mucopurulent discharge but not the thick white discharge described. Herpes simplex virus (C) presents with painful vesicular or ulcerative lesions. Human papillomavirus (D) is associated with genital warts (condyloma acuminata) or cervical dysplasia, not acute vaginitis with white discharge. Furthermore, the patient's 25-year monogamous relationship decreases the likelihood of newly acquired sexually transmitted infections (B, C, D, E) compared to an opportunistic fungal overgrowth.

## Question 5.1

A 39-year-old man comes to the physician because of a 6-month history of progressive shortness of breath. He has had a cough productive of white sputum for 2 years. He smoked 1 pack of cigarettes daily for 16 years but quit 10 years ago. He is in mild respiratory distress with pursed lips and a barrel chest; he is using the accessory muscles of respiration. Breath sounds are distant and crackles are present in the lower lung fields bilaterally. Pulmonary function tests show a decreased  $FEV_1:FVC$  ratio, increased residual volume, and decreased diffusion capacity. An x-ray of the chest shows hyperinflation and hypertranslucency of the lower lobes of both lungs. Which of the following is the most likely diagnosis?

- (A) Asthma
- (B) Bronchiectasis
- (C) Chronic pulmonary fibrosis
- (D) Cystic fibrosis
- (E) Emphysema

**Correct Answer:**

- (E) Emphysema

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** The patient's clinical presentation and pulmonary function tests (PFTs) are diagnostic of emphysema. The decreased  $FEV_1:FVC$  ratio and increased residual volume indicate an obstructive lung disease with air trapping. The key differentiator among obstructive diseases is the decreased diffusion capacity (DLCO), which signifies the destruction of the alveolar-capillary interface, a hallmark of emphysema. Physical findings such as the barrel chest, pursed-lip breathing, and accessory muscle use are classic for 'pink puffers' (emphysema-predominant COPD). While the patient has a smoking history, the specific mention of hyperinflation and hypertranslucency in the lower lobes in a relatively young patient (39 years old) is highly suggestive of alpha-1 antitrypsin deficiency, which leads to panacinar emphysema. (A) Asthma would typically show a normal or increased DLCO and reversible obstruction. (B) Bronchiectasis involves permanent dilation of the bronchi and usually presents with copious purulent sputum and distinct CT findings. (C) Chronic pulmonary fibrosis is a restrictive lung disease, which would show an increased  $FEV_1:FVC$  ratio and decreased lung volumes. (D) Cystic fibrosis typically presents earlier in life with recurrent infections and multisystem involvement.

## Question 6.1

A previously healthy 33-year-old woman is brought to the emergency department by the Secret Service for stalking the president of the USA for 2 months. She claims to be married to the president's twin brother and states that the president just had his twin kidnapped to avoid competition. She speaks rapidly and is difficult to interrupt. Her associations are often loose. She says, "I haven't slept for days, but I won't even try to sleep until my husband is rescued. God has been instructing me to take over the White House. I can't wait to be reunited with my husband. I hear his voice telling me what to do." When asked about drug use, she says she uses only natural substances. She refuses to permit blood or urine tests, saying, "I don't have time to wait for the results." Which of the following is the most likely diagnosis?

- (A) Bipolar disorder, manic, with psychotic features
- (B) Brief psychotic disorder
- (C) Delusional disorder
- (D) Psychotic disorder due to general medical condition
- (E) Schizophrenia

**Correct Answer:**

- (A) Bipolar disorder, manic, with psychotic features

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient's presentation is a classic manifestation of a manic episode with psychotic features. According to DSM-5 criteria, a manic episode requires a period of abnormally elevated or irritable mood and increased energy lasting at least one week. This patient demonstrates several hallmark symptoms: grandiosity (claiming to be married to the President's twin and being instructed by God), decreased need for sleep (not sleeping for days but remaining energetic), pressured speech (rapid and difficult to interrupt), and flight of ideas (loose associations). The presence of delusions (the kidnapping plot) and auditory hallucinations (hearing her 'husband's' voice) classifies the episode as having psychotic features. (B) is incorrect because the symptoms have lasted at least 2 months and include prominent mood/manic symptoms. (C) is incorrect because delusional disorder is characterized by delusions without prominent hallucinations or the 'bizarre' manic behavior and pressured speech seen here. (D) is less likely as there are no physical exam findings or history suggesting a specific medical etiology, despite her refusal of tests. (E) is incorrect because schizophrenia requires at least 6 months of symptoms and the prominent, driving force of this presentation is the manic syndrome (mood, energy, and speech changes) rather than primary negative symptoms or disorganized behavior alone.

## Question 8.1

A 53-year-old man comes to the physician because of a dry scaly rash on his body for the past year. He has had a 15-kg (33-lb) weight loss during the past year. He is 178 cm (5 ft 10 in) tall and now weighs 54 kg (120 lb); BMI is 17 kg/m<sup>2</sup>. His stools have a large volume and float. Which of the following nutrient deficiencies is most likely?

- (A) Magnesium
- (B) Vitamin A
- (C) Vitamin B<sub>12</sub> (cobalamin)
- (D) Vitamin C
- (E) Zinc

**Correct Answer:**

- (B) Vitamin A

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The patient presents with significant weight loss (15 kg), a low BMI ( $17 \text{ kg/m}^2$ ), and large-volume, floating stools, which are classic indicators of steatorrhea (fat malabsorption). Steatorrhea occurs when there is an inability to digest or absorb dietary fats, which consequently leads to the malabsorption of fat-soluble vitamins (A, D, E, and K). Among the options provided, Vitamin A is the only fat-soluble vitamin. A deficiency in Vitamin A characteristically presents with ocular symptoms (night blindness, xerophthalmia) and cutaneous manifestations, specifically follicular hyperkeratosis and xerosis (dry, scaly skin), which matches this patient's 'dry scaly rash.' While Zinc deficiency (Option E) can cause skin changes, it typically presents as periorificial and acral dermatitis (acrodermatitis enteropathica). Vitamin B<sub>12</sub> (Option C) and Magnesium (Option A) deficiencies can occur in generalized malabsorption but do not typically cause a dry, scaly rash. Vitamin C (Option D) is water-soluble and its deficiency (scurvy) presents with petechiae, ecchymoses, and corkscrew hairs rather than generalized scaling.

## Question 9.1

In screening for prostate cancer, the current serum prostate-specific antigen concentration at which biopsy is recommended is 4.1 ng/mL. If the threshold for recommending a biopsy procedure were lowered to 2.0 ng/mL, which of the following changes would occur to the positive and negative predictive values of the test?

- (A) Positive Predictive Value and Negative Predictive Value increase
- (B) Positive Predictive Value increase and Negative Predictive Value no change
- (C) Positive Predictive Value increase and Negative Predictive Value decrease
- (D) Positive Predictive Value no change and Negative Predictive Value increase
- (E) Positive Predictive Value and Negative Predictive Value no change
- (F) Positive Predictive Value no change and Negative Predictive Value decrease
- (G) Positive Predictive Value decrease and Negative Predictive Value increase
- (H) Positive Predictive Value decrease and Negative Predictive Value no change
- (I) Positive Predictive Value and Negative Predictive Value decrease

**Correct Answer:**

(G) Positive Predictive Value decrease and Negative Predictive Value increase

**Neural Consult Response and Explanation:**



**Answer:** G

**Explanation:** To determine the effect of lowering a diagnostic threshold on predictive values, we must analyze how sensitivity and specificity change. Lowering the threshold for a positive test (from 4.1 ng/mL to 2.0 ng/mL) makes the test more sensitive but less specific. 1) Positive Predictive Value (PPV): PPV is the proportion of patients with a positive test who actually have the disease. By lowering the threshold, we capture more 'positives,' but a larger proportion of these new positives will be false positives (individuals with PSA between 2.0 and 4.1 who have benign conditions like BPH or prostatitis rather than cancer). As the number of false positives increases more rapidly than the number of true positives in this lower range, the PPV decreases. 2) Negative Predictive Value (NPV): NPV is the proportion of patients with a negative test who are truly free of the disease. By lowering the threshold, we reduce the number of false negatives (people with cancer who previously had a 'normal' PSA between 2.0 and 4.1). Since the number of false negatives in the 'negative' group decreases, we can be more confident that a negative result truly means the absence of disease. Therefore, the NPV increases. Thus, lowering the threshold leads to a decrease in PPV and an increase in NPV.

## Question 10.1

In informing a couple that their newborn has Down syndrome, there is a specific, relatively limited amount of information that the consulting physician should give immediately. The rest can be discussed at a later time. Which of the following best explains the purpose of using this approach to disclosure?

- (A) Allowing the couple's primary care physician to discuss most of the information with them
- (B) Allowing the parents time to tell other family members
- (C) Delaying parental distress until the information is completely disclosed
- (D) Disclosing the most important information so that it can be understood as fully as possible
- (E) Influencing the parents' course of action about what is medically most appropriate

**Correct Answer:**

- (D) Disclosing the most important information so that it can be understood as fully as possible

**Neural Consult Response and Explanation:**



**Answer: D**

**Explanation:** When delivering a life-altering diagnosis such as Down syndrome, parents often experience immediate emotional shock, which significantly impairs their cognitive ability to process complex or voluminous information. This phenomenon is a well-recognized barrier in patient-centered communication. By limiting the initial disclosure to the most essential facts, the physician prevents 'information overload' and ensures that the most critical points are understood as fully as possible. This approach prioritizes the quality of understanding over the quantity of information. Option A is incorrect because the consulting physician still bears the responsibility for the initial disclosure. Option B is a secondary outcome but not the primary clinical purpose of the communication strategy. Option C is incorrect because distress is an inevitable part of the process and cannot be 'delayed' simply by withholding details; rather, the goal is to communicate effectively despite the distress. Option E is incorrect as the goal of disclosure should be to provide objective information for informed consent and shared decision-making, not to manipulate or influence the parents toward a specific course of action.

## Question 12.1

A 62-year-old man comes to the physician because of a 6-month history of urinary hesitancy and dribbling after urination. He has to urinate two to three times nightly. Physical examination shows a diffusely enlarged, firm, and nontender prostate. Which of the following is most likely to have contributed to the development of this patient's condition?

- (A) Activation of the  $\alpha$ 1-adrenergic receptor
- (B) Conversion of testosterone to dihydrotestosterone
- (C) Conversion of testosterone to estradiol
- (D) Inhibition of the  $\alpha$ 1-adrenergic receptor
- (E) Production of prostate-specific antigen

**Correct Answer:**

- (B) Conversion of testosterone to dihydrotestosterone

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The patient presents with classic symptoms of Benign Prostatic Hyperplasia (BPH), including urinary hesitancy, post-void dribbling, and nocturia, alongside a diffusely enlarged prostate on examination. The pathophysiology of BPH involves both a 'static' component (physical enlargement of the gland) and a 'dynamic' component (smooth muscle tone). The development of the static component—the actual hyperplasia of the stromal and epithelial cells—is primarily driven by dihydrotestosterone (DHT). In the prostate, the enzyme 5-alpha-reductase converts testosterone into DHT, which has a much higher affinity for androgen receptors and acts as the main hormonal mediator of prostatic growth. While alpha-1 adrenergic receptor activation (Option A) contributes to the dynamic obstruction and worsening of symptoms, it does not cause the underlying cellular hyperplasia. Options C, D, and E are incorrect because estradiol is not the primary driver of BPH, alpha-1 inhibition is a treatment rather than a cause, and PSA is a biomarker produced by the prostate rather than a causative agent for its growth.

### Question 13.1

An 18-year-old woman with sickle cell disease is brought to the emergency department by her parents because of a 2-hour history of severe abdominal pain and nausea. Her parents say that she had a cheeseburger, milk shake, and chocolate bar for lunch. Her temperature is 37°C (98.6°F). Physical examination shows tenderness over the right upper quadrant of the abdomen, radiating to the right shoulder. Ultrasonography of the right upper quadrant of the abdomen shows gallstones. Which of the following is the most likely underlying cause of this patient's current condition?

- (A) Decreased hepatic secretion of lecithin
- (B) Decreased reabsorption of bile salts
- (C) High ratio of cholesterol to bile acids in bile
- (D) Infestation with parasites secreting  $\beta$ -glucuronidase
- (E) Overload of unconjugated bilirubin

**Correct Answer:**

- (E) Overload of unconjugated bilirubin

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** The patient is an 18-year-old with sickle cell disease (SCD) presenting with biliary colic (RUQ pain radiating to the shoulder after a fatty meal) and ultrasound-confirmed cholelithiasis. In patients with SCD, the underlying mechanism for gallstone formation is chronic extravascular hemolysis. Continuous destruction of sickled red blood cells leads to an excessive production of heme, which is metabolized into unconjugated bilirubin. This 'overload of unconjugated bilirubin' exceeds the liver's conjugating capacity or leads to high concentrations of conjugated bilirubin in the bile that can be deconjugated by endogenous glucuronidases. The resulting free bilirubin precipitates with calcium to form black pigment stones (calcium bilirubinate). Options A, B, and C describe mechanisms for cholesterol gallstones, which are less common in young patients with hemolytic disorders. Option D refers to brown pigment stones, which typically form in the bile ducts due to bacterial or parasitic infections (like *Clonorchis sinensis*) that produce beta-glucuronidase, but this is not the primary mechanism associated with sickle cell disease.

## Question 14.1

A 45-year-old man is brought to the emergency department 30 minutes after the sudden onset of crushing chest pain. His father, maternal aunt, and paternal uncle all died of myocardial infarctions under the age of 50 years. Physical examination shows tendinous xanthomas on the hands and thickened Achilles tendons. Serum lipid studies show a total cholesterol concentration of 410 mg/dL, HDL-cholesterol concentration of 30 mg/dL, and triglyceride concentration of 140 mg/dL. The diagnosis of myocardial infarction is made. This patient most likely has a deficiency of which of the following?

- (A) Apo B<sub>48</sub>
- (B) Apo C
- (C) HMG-CoA reductase activity
- (D) LDL receptor
- (E) Lipoprotein lipase activity

**Correct Answer:**

(D) LDL receptor

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The patient's clinical presentation is classic for Familial Hypercholesterolemia (FH), specifically Type IIa hyperlipoproteinemia. Key features include a total cholesterol of 410 mg/dL (with a calculated LDL-C of approximately 352 mg/dL), normal triglycerides (140 mg/dL), and pathognomonic physical findings: tendinous xanthomas on the hands and thickened Achilles tendons. FH is an autosomal dominant disorder most commonly caused by a deficiency or defect in the LDL receptor (LDLR), which is responsible for the hepatic uptake of LDL particles from the circulation. This deficiency leads to lifelong elevation of LDL-C and premature atherosclerotic cardiovascular disease, explaining the patient's myocardial infarction at age 45 and his extensive family history of early cardiac deaths. Option A (Apo B<sub>48</sub>) is involved in chylomicron secretion from the intestine. Option B (Apo C-II) and Option E (Lipoprotein lipase) are involved in triglyceride metabolism; deficiencies in these would lead to severe hypertriglyceridemia and potentially pancreatitis, rather than isolated hypercholesterolemia. Option C (HMG-CoA reductase) is the rate-limiting enzyme for cholesterol synthesis; a deficiency would decrease cholesterol production rather than increase serum levels.

## Question 15.1

An experimental animal is created in which the germinal centers of the reactive lymph nodes show shrinkage of cells, cytoplasmic budding, no adjacent inflammation, and intact plasma membranes. These cellular findings are most likely caused by which of the following mechanisms?

- (A) Caspase activation
- (B) Decreased cytochrome c concentration
- (C) Decreased intracellular Ca<sub>2+</sub> concentration
- (D) Increased glutathione peroxidase activity
- (E) Increased lysosomal enzyme activity

**Correct Answer:**

- (A) Caspase activation

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The cellular findings described—cell shrinkage, cytoplasmic budding (blebbing), intact plasma membranes, and the absence of adjacent inflammation—are classic hallmarks of apoptosis. Unlike necrosis, which involves cell swelling, membrane rupture, and an inflammatory response due to the leakage of cellular contents, apoptosis is a programmed, controlled process. The central executioners of apoptosis are a family of cysteine-aspartic acid proteases known as caspases. Once activated via either the intrinsic (mitochondrial) or extrinsic (death receptor) pathway, executioner caspases (such as caspase-3 and -6) cleave structural proteins like nuclear lamins and the cytoskeleton, leading to the characteristic morphological changes observed. Regarding the other options: (B) is incorrect because the release of cytochrome c into the cytoplasm (increasing its concentration) is what triggers the caspase cascade; (C) is incorrect as increased, not decreased, intracellular calcium can sometimes trigger cell death; (D) glutathione peroxidase is an antioxidant that protects against oxidative stress; and (E) lysosomal enzyme leakage is characteristic of necrosis, not the orderly process of apoptosis.

## Question 16.1

Investigators conduct a study that evaluates the effect of finasteride on the incidence of prostate cancer in 500 patients. The investigators recruit an additional 1000 patients for the study. Which of the following effects will this have on the research study?

- (A) Greater chance of a Type I error
- (B) Greater chance of a Type II error
- (C) Less chance of a Type I error
- (D) Less chance of a Type II error
- (E) Impossible to predict

**Correct Answer:**

- (D) Less chance of a Type II error

### Neural Consult Response and Explanation:

**Answer:** D

**Explanation:** In clinical research, the sample size is a critical determinant of statistical power. Statistical power ( $1 - \beta$ ) is the probability that a study will detect a statistically significant difference when one truly exists. A Type II error ( $\beta$ ) occurs when the study fails to reject the null hypothesis despite the presence of a true effect (a false negative). By increasing the sample size from 500 to 1500 patients, the investigators increase the study's power, thereby reducing the probability of committing a Type II error. Conversely, a Type I error ( $\alpha$ ) is the probability of rejecting the null hypothesis when it is actually true (a false positive). The Type I error rate is an a priori threshold set by the researchers (typically at 0.05) and is not inherently reduced or increased by simply changing the sample size. Therefore, the primary statistical impact of adding more patients is a reduction in the chance of a Type II error.



## Question 17.1

A 76-year-old man dies of a massive cerebral infarction shortly after admission to the hospital. During the past 10 years, he has had several smaller cerebral infarctions and two transient ischemic attacks. Examination of a cerebral cortex specimen obtained at autopsy shows extensive gliosis. This finding is most likely caused by the growth and proliferation of which of the following?

- (A) Astrocytes
- (B) Ependymal cells
- (C) Fibroblasts
- (D) Microglial cells
- (E) Oligodendrocytes

### Correct Answer:

- (A) Astrocytes

### Neural Consult Response and Explanation:

**Answer:** A

**Explanation:** In the central nervous system (CNS), the response to injury, such as a cerebral infarction, differs from peripheral tissues. Instead of fibroblast-mediated scarring, the CNS undergoes a process known as gliosis. Astrocytes are the primary cells responsible for this repair mechanism. Following neuronal death and the subsequent removal of debris by microglial cells (the CNS macrophages), astrocytes undergo hypertrophy and hyperplasia (proliferation). They extend their cytoplasmic processes and increase the production of intermediate filaments, specifically glial fibrillary acidic protein (GFAP), to form a permanent 'glial scar' that fills the void left by the necrotic tissue. While microglial cells (D) are active in the acute phase for phagocytosis, they do not form the structural scar tissue. Ependymal cells (B) line the ventricles, fibroblasts (C) are generally absent from the CNS parenchyma except in the meninges or around large vessels, and oligodendrocytes (E) are responsible for myelination and do not contribute to the formation of extensive gliosis.

## Question 19.1

A previously healthy 52-year-old woman comes to the physician because of a 2-month history of fatigue, constipation, and frequent urination. Her temperature is 37.1°C (98.8°F), pulse is 80/min, respirations are 14/min, and blood pressure is 140/90 mm Hg. Diffuse crackles are heard bilaterally. Her serum calcium concentration is 11.1 mg/dL, and serum parathyroid hormone concentration is decreased. A chest x-ray shows bilateral hilar lymphadenopathy and interstitial infiltrates. Which of the following is the most likely cause of this patient's hypercalcemia?

- (A) Calcitriol production by activated macrophages
- (B) Local resorption of bone by metastases



- (C) Parathyroid hormone-related peptide secretion
- (D) Secretion of parathyroid hormone
- (E) Secretion of thyroid-stimulating hormone

**Correct Answer:**

- (A) Calcitriol production by activated macrophages

**Neural Consult Response and Explanation:**

**Answer:** A

**Explanation:** The patient presents with symptoms of hypercalcemia (fatigue, constipation, polyuria) and a chest x-ray showing bilateral hilar lymphadenopathy and interstitial infiltrates, which is classic for sarcoidosis. Laboratory findings confirm hypercalcemia (11.1 mg/dL) with a suppressed parathyroid hormone (PTH) level, indicating a non-PTH-mediated cause. In sarcoidosis and other granulomatous diseases, activated macrophages within the granulomas contain the enzyme 1-alpha-hydroxylase. This enzyme converts 25-hydroxyvitamin D into its active form, 1,25-dihydroxyvitamin D (calcitriol), in an unregulated fashion. Elevated calcitriol levels increase intestinal calcium absorption and bone resorption, leading to hypercalcemia. Option B and C are causes of malignancy-associated hypercalcemia; while possible, the radiographic findings are pathognomonic for sarcoidosis. Option D is incorrect because the PTH is suppressed. Option E is unrelated to the primary mechanism of hypercalcemia in this clinical context.

---

**Question 20.1**

A 66-year-old man who was recently diagnosed with Parkinson disease comes to the physician for a follow-up examination. Carbidopa-levodopa therapy was initiated at the time of diagnosis. The patient tells the physician that he still has episodes during which he "freezes." He has a clumsy gait, and there is rigidity of his upper extremities and hands. An adjunct therapy designed to inhibit which of the following enzymes is most likely indicated in this patient?

- (A) Aromatic L-amino acid decarboxylase
- (B) Dopamine  $\beta$ -hydroxylase
- (C) Monoamine oxidase B
- (D) Phenylethanolamine N-methyltransferase
- (E) Tyrosine hydroxylase

**Correct Answer:**

- (C) Monoamine oxidase B

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The patient is experiencing motor fluctuations (specifically 'freezing' and persistent rigidity) despite being on carbidopa-levodopa therapy. This clinical scenario describes the 'wearing-off' phenomenon or 'off' periods common in Parkinson disease management. To address this, adjunctive therapies are used to prolong the half-life of dopamine in the brain. Monoamine oxidase B (MAO-B) is one of the primary enzymes responsible for the degradation of dopamine in the central nervous system. Inhibitors of MAO-B (such as selegiline or rasagiline) prevent the breakdown of dopamine, thereby increasing its availability in the synaptic cleft and extending the clinical benefit of levodopa. (A) Aromatic L-amino acid decarboxylase (DOPA decarboxylase) is the enzyme that converts levodopa to dopamine; carbidopa already inhibits this enzyme peripherally, and further inhibition is not the standard next step for motor fluctuations. (B) Dopamine  $\beta$ -hydroxylase converts dopamine to norepinephrine; while its inhibition could theoretically increase dopamine, it is not a standard clinical treatment for Parkinson's. (D) Phenylethanolamine N-methyltransferase converts norepinephrine to epinephrine and is not relevant to Parkinson's therapy. (E) Tyrosine hydroxylase is the rate-limiting step in dopamine synthesis; inhibiting it would worsen the patient's condition by reducing endogenous dopamine production.

## Question 22.1

A 46-year-old woman comes to the physician because of a 3-day history of intermittent pain with urination and increased urinary frequency. She says that she had one similar episode during the past 6 months. She also has had irregular menses, and her last menstrual period occurred 2 months ago. She has not had fever, nausea, vomiting, or blood in her urine. She is sexually active with one male partner. Physical examination shows no abnormalities.

Urinalysis shows:

RBC 3–5/hpf WBC 10–20/hpf Nitrites positive  
Leukocyte esterase positive  
Bacteria positive

Which of the following is the strongest predisposing risk factor for the development of this patient's condition?

- (A) Leiomyomata uteri
- (B) Perimenopause
- (C) Pregnancy
- (D) Sexual intercourse

**Correct Answer:**

(D) Sexual intercourse

**Neural Consult Response and Explanation:**



**Answer: D**

**Explanation:** The patient presents with classic symptoms of acute cystitis (dysuria, frequency) and a positive urinalysis (nitrites, leukocyte esterase, bacteria). The question asks for the 'strongest' predisposing risk factor. While the patient's age (46) and irregular menses (last period 2 months ago) suggest she is entering perimenopause, sexual intercourse remains the most significant independent risk factor for the development of cystitis in premenopausal and perimenopausal women. Sexual activity facilitates the mechanical translocation of periurethral flora (most commonly *E. coli*) into the bladder. While estrogen deficiency in the postmenopausal state significantly alters vaginal pH and flora (increasing UTI risk), this patient is still menstruating (albeit irregularly), suggesting she is not yet at the level of profound estrogen deficiency seen in late menopause that would supersede sexual intercourse as the primary risk factor. Leiomyomata uteri (A) rarely cause UTIs unless they are large enough to cause urinary stasis. Pregnancy (C) is a risk factor, but there is no evidence provided that she is pregnant. Epidemiological studies consistently identify sexual intercourse as the strongest behavioral risk factor for cystitis in women before the complete onset of menopause.

### Question 23.1

A 28-year-old man comes to the physician because of a 2-month history of a rash on his wrists and hands. He is a first-year mortuary science student. He also works on his grandfather's farm each weekend. His hobbies include raising homing pigeons and repairing vintage motorcycles. He recently changed to a different type of laundry detergent to save money. Physical examination shows a diffuse erythematous rash involving both hands up to the wrist creases. The rash does not extend over any other parts of the body. Which of the following is the most likely cause of this patient's rash?

- (A) Change in laundry detergent
- (B) Exposure to chemicals during motorcycle repair
- (C) Handling pigeons
- (D) Pesticide exposure
- (E) Use of latex gloves

**Correct Answer:**

(E) Use of latex gloves

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** The patient presents with a diffuse erythematous rash that is sharply demarcated at the wrist creases, involving only the hands. This clinical pattern is classic for contact dermatitis (either irritant or allergic) caused by an object worn on the hands. The most significant clue in the patient's history is that he is a first-year mortuary science student. Students in this field are required to wear protective gloves (typically latex or nitrile) for extended periods during dissection and embalming procedures. The 'glove-like' distribution—ending exactly where a glove cuff would sit—is the pathognomonic feature of this case. While other options involve potential irritants, they do not explain the specific distribution as well as gloves do: (A) Laundry detergent would typically cause a more generalized rash or affect areas where clothes rub against the skin (like the trunk or limbs). (B) Motorcycle repair involves chemicals, but exposure is usually more irregular and less likely to produce a perfect wrist-line demarcation. (C) Handling pigeons is more associated with respiratory issues (hypersensitivity pneumonitis) or specific infections, not a localized hand rash. (D) Pesticide exposure on a farm would likely be more haphazard in distribution. Therefore, the use of latex gloves in his new professional training is the most likely culprit.

## Question 24.1

A 10-year-old boy is brought to the emergency department in the middle of summer because of fever, headache, and photophobia. Several of his camp mates have had a similar illness. Physical examination shows mild nuchal rigidity. A lumbar puncture is performed. Laboratory studies show:

Serum glucose 90 mg/dL

Cerebrospinal fluid Pressure, opening 50 mm H<sub>2</sub>O Glucose 65 mg/dL

Total protein 70 mg/dL

Leukocyte count 43/mm<sup>3</sup>

(95% lymphocytes)

Which of the following infectious agents is the most likely cause of these findings?

- (A) Adenovirus
- (B) Enterovirus
- (C) Herpes simplex virus
- (D) Neisseria meningitidis
- (E) Streptococcus pneumoniae

**Correct Answer:**

(B) Enterovirus

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The clinical presentation and laboratory findings point to a diagnosis of viral (aseptic) meningitis. The patient exhibits classic symptoms (fever, headache, photophobia, and nuchal rigidity) in a specific epidemiological context: mid-summer and a cluster of cases among camp mates. Enteroviruses (including Coxsackievirus and Echovirus) are the most common cause of aseptic meningitis, particularly in children and adolescents, and they characteristically peak in the summer and early fall. The cerebrospinal fluid (CSF) analysis is the definitive evidence for a viral etiology: 1) The leukocyte count is elevated ( $43/\text{mm}^3$ ) but relatively low compared to bacterial meningitis; 2) There is a strong lymphocytic predominance (95%), which is typical of viral infections; 3) The glucose level is normal (65 mg/dL, which is >60% of the serum glucose of 90 mg/dL), whereas bacterial infections typically consume glucose; and 4) The protein is only mildly elevated (70 mg/dL). Bacterial causes like *Neisseria meningitidis* (D) and *Streptococcus pneumoniae* (E) are ruled out by the lymphocytic predominance and normal glucose, as they would typically show a neutrophilic pleocytosis and low glucose. Adenovirus (A) is a less common cause of meningitis and lacks the strong summer seasonality of Enteroviruses. Herpes simplex virus (C) typically presents more sporadically and often involves more severe neurological symptoms or focal findings (encephalitis) rather than a mild camp outbreak of meningitis.

## Question 25.1

A healthy 30-year-old woman participates in a study of the relationship between cardiovascular function and posture. Placed in a room with a comfortable temperature (72°F) and humidity (40%), she moves from a standing to a supine position. Which of the following sets of changes is most likely in the reflex control of this woman's cardiovascular system?

- (A) Carotid Sinus Baroreceptor Activity, Atrial Stretch Receptor Activity, and Vagal Efferent Activity to the Heart increase
- (B) Carotid Sinus Baroreceptor Activity and Atrial Stretch Receptor Activity increase, while Vagal Efferent Activity to the Heart decrease
- (C) Carotid Sinus Baroreceptor Activity and Vagal Efferent Activity to the Heart increase, while Atrial Stretch Receptor Activity decrease
- (D) Carotid Sinus Baroreceptor Activity increase, while Atrial Stretch Receptor Activity and Vagal Efferent Activity to the Heart decrease
- (E) Carotid Sinus Baroreceptor Activity decrease, while Atrial Stretch Receptor Activity and Vagal Efferent Activity to the Heart increase
- (F) Carotid Sinus Baroreceptor Activity and Vagal Efferent Activity to the Heart decrease, while Atrial Stretch Receptor Activity increase
- (G) Carotid Sinus Baroreceptor Activity and Atrial Stretch Receptor Activity decrease, while Vagal Efferent Activity to the Heart increase
- (H) Carotid Sinus Baroreceptor Activity, Atrial Stretch Receptor Activity, and Vagal Efferent Activity to the Heart decrease

**Correct Answer:**

(A) Carotid Sinus Baroreceptor Activity, Atrial Stretch Receptor Activity, and Vagal Efferent Activity to the Heart increase



## Neural Consult Response and Explanation:

**Answer:** A

**Explanation:** When a person moves from a standing to a supine position, the gravitational effects that previously caused blood to pool in the lower extremities are removed. This results in a significant shift of blood volume from the legs and splanchnic circulation back toward the thorax, increasing venous return and central blood volume. 1) Carotid Sinus Baroreceptor Activity: The increase in venous return leads to an increase in stroke volume and cardiac output (Frank-Starling mechanism), which subsequently increases mean arterial blood pressure. The carotid sinus baroreceptors respond to this increased stretch/pressure by increasing their firing rate. 2) Atrial Stretch Receptor Activity: The increased central blood volume directly increases the 'fullness' of the heart, stretching the low-pressure receptors in the atria. This leads to an increase in atrial stretch receptor activity. 3) Vagal Efferent Activity: The central nervous system processes the increased afferent signaling from both the arterial baroreceptors and the atrial stretch receptors as a signal of high pressure/volume. The compensatory reflex response is to increase parasympathetic (vagal) outflow to the sinoatrial node to decrease the heart rate and decrease sympathetic outflow to the heart and vasculature. Therefore, all three parameters—carotid sinus baroreceptor activity, atrial stretch receptor activity, and vagal efferent activity—**increase**.

## Question 26.1

A 31-year-old woman with a 5-year history of fatigue comes to the physician for an initial visit. She has seen four other physicians for the same condition within the past 6 months, but no abnormalities were found. She gives the physician a large folder that contains her medical records. She says, "I can barely get out of bed most mornings, but nobody can figure out why because all of my tests turn out normal. I really think I have chronic fatigue syndrome. What do you know about this condition?" The physician has not treated any patient with chronic fatigue syndrome before. Which of the following initial statements by the physician is most appropriate to establish rapport with this patient?

- (A) "From the size of the folder you brought, it looks like you've had very thorough examinations in the past."
- (B) "I don't have much experience with chronic fatigue syndrome, but I'm committed to learning as much as I can about it."
- (C) "I'm not familiar with chronic fatigue syndrome, except that many physicians don't think it's a real disease."
- (D) "Let's start over from scratch. We'll need to repeat complete testing."
- (E) "When nothing abnormal is found during thorough examinations and laboratory studies, there is often an underlying psychological cause of the symptoms."

### Correct Answer:

(B) "I don't have much experience with chronic fatigue syndrome, but I'm committed to learning as much as I can about it."



## Neural Consult Response and Explanation:

**Answer:** B

**Explanation:** Establishing rapport with a patient who feels dismissed by the medical community requires honesty, validation, and a commitment to partnership. This patient has a chronic condition and feels that her previous physicians have failed to find an answer, leading to a sense of frustration. Option (B) is the most appropriate response because it demonstrates professional humility by admitting a lack of specific experience, while simultaneously validating the patient's concerns by expressing a willingness to learn and partner with her in her care. This approach fosters a collaborative relationship rather than a dismissive one. Option (A) is observant but passive. Option (C) is highly invalidating and would likely damage the physician-patient relationship immediately. Option (D) ignores the extensive work already done, which can be frustrating and costly for the patient. Option (E) is dismissive and prematurely labels the condition as psychosomatic, which is exactly what patients with chronic fatigue syndrome often find alienating about the medical establishment.

## Question 27.1

A 3-week-old girl delivered at term with no complications is brought to the physician by her mother because of a 1-week history of yellow eyes and skin, tan-colored stools, and dark brown urine. The newborn has been breast-feeding without difficulty. She is alert and appears to be in no distress. She is at the 50th percentile for length and weight. Physical examination shows scleral icterus and jaundice. There is mild hepatomegaly; the spleen is not palpable. Laboratory studies show:

Hemoglobin 14.4 g/dL

Hematocrit 43%

Leukocyte count 8000/mm<sup>3</sup>

Serum Albumin 3.5 g/dL

Serum Total Bilirubin 14 mg/dL

Direct Bilirubin 12.5 mg/dL

AST 50 U/L

ALT 45 U/L

Which of the following is the most likely diagnosis?

- (A) Biliary atresia
- (B) Crigler-Najjar syndrome, type I
- (C) Gilbert syndrome
- (D) Hemolytic disease of the newborn
- (E) Physiologic jaundice

**Correct Answer:**

(A) Biliary atresia



## Neural Consult Response and Explanation:

**Answer:** A

**Explanation:** The patient's clinical presentation and laboratory findings are diagnostic of neonatal cholestasis, for which biliary atresia is the most common and critical cause. The key finding is a conjugated (direct) hyperbilirubinemia, defined as a direct bilirubin  $>1.0$  mg/dL or  $>20\%$  of the total bilirubin. This patient has a direct bilirubin of 12.5 mg/dL (89% of the total 14 mg/dL). The presence of 'tan-colored' (acholic) stools indicates a lack of bile pigment reaching the gastrointestinal tract due to biliary obstruction, while 'dark brown urine' reflects the renal excretion of water-soluble conjugated bilirubin. Biliary atresia typically presents in the first few weeks of life in an otherwise well-appearing infant with hepatomegaly. Options B, C, and E (Crigler-Najjar, Gilbert syndrome, and physiologic jaundice) are characterized by unconjugated hyperbilirubinemia. Option D (Hemolytic disease) also causes unconjugated hyperbilirubinemia and would typically present with anemia, which is absent here (Hemoglobin 14.4 g/dL).

## Question 28.1

A 65-year-old woman comes to the physician for a follow-up examination after blood pressure measurements were 175/105 mm Hg and 185/110 mm Hg 1 and 3 weeks ago, respectively. She has well-controlled type 2 diabetes mellitus. Her blood pressure now is 175/110 mm Hg. Physical examination shows no other abnormalities. Antihypertensive therapy is started, but her blood pressure remains elevated at her next visit 3 weeks later. Laboratory studies show increased plasma renin activity; the erythrocyte sedimentation rate and serum electrolytes are within the reference ranges. Angiography shows a high-grade stenosis of the proximal right renal artery; the left renal artery appears normal. Which of the following is the most likely diagnosis?

- (A) Atherosclerosis
- (B) Congenital renal artery hypoplasia
- (C) Fibromuscular dysplasia
- (D) Takayasu arteritis
- (E) Temporal arteritis

**Correct Answer:**

- (A) Atherosclerosis

## Neural Consult Response and Explanation:



**Answer:** A

**Explanation:** The patient is a 65-year-old woman with type 2 diabetes mellitus presenting with resistant hypertension and elevated plasma renin activity. Angiography reveals high-grade stenosis of the proximal right renal artery. These findings are classic for atherosclerotic renal artery stenosis (ARAS).

Atherosclerosis is the most common cause of renal artery stenosis (accounting for >90% of cases) and typically affects older patients with risk factors such as diabetes. Anatomically, atherosclerotic plaques are characteristically found at the ostium or the proximal third of the renal artery. The elevated renin is a physiological response to perceived low perfusion in the stenotic kidney (Goldblatt kidney mechanism).

Fibromuscular dysplasia (C) is the second most common cause but typically affects younger women (ages 15-50) and involves the mid-to-distal portions of the renal artery with a 'string of beads' appearance.

Takayasu arteritis (D) is a large-vessel vasculitis that can cause renal artery stenosis but usually presents in patients under age 40 and is often accompanied by systemic symptoms and an elevated ESR, which is normal in this patient. Temporal arteritis (E) affects the branches of the carotid artery and does not typically involve the renal arteries. Congenital renal artery hypoplasia (B) would likely have been detected earlier in life and does not typically present as a focal high-grade stenosis in an elderly patient with metabolic risk factors.

## Question 29.1

Results of a study that examined the impact of risk factors on cardiovascular health are being evaluated. In the study, serum LDL-cholesterol (LDL) concentration is found to have a correlation of 0.6 with serum high-sensitivity C-reactive protein (hs-CRP) concentration. Which of the following statements best describes the relationship between LDL concentration and hs-CRP concentration based on this finding?

- (A) Higher LDL concentrations are associated with higher hs-CRP concentrations
- (B) Higher LDL concentrations are associated with lower hs-CRP concentrations
- (C) Higher LDL concentrations cause higher hs-CRP concentrations
- (D) Higher LDL concentrations cause lower hs-CRP concentrations

**Correct Answer:**

(A) Higher LDL concentrations are associated with higher hs-CRP concentrations

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The question provides a correlation coefficient ( $r$ ) of 0.6 between serum LDL-cholesterol and high-sensitivity C-reactive protein (hs-CRP). In statistics, a positive correlation coefficient ( $0 < r \leq 1$ ) indicates a direct relationship where, as one variable increases, the other variable also tends to increase. Therefore, higher LDL concentrations are associated with higher hs-CRP concentrations. Option (B) is incorrect because it describes a negative correlation ( $r < 0$ ). Options (C) and (D) are incorrect because they imply causation. A fundamental principle of biostatistics is that 'correlation does not imply causation'; a correlation coefficient measures the strength and direction of a linear relationship between two variables but does not prove that changes in one variable are responsible for changes in the other. While both LDL and hs-CRP are markers of cardiovascular risk and inflammation, the statistical finding of  $r = 0.6$  only supports an association.

## Question 31.1

A 72-year-old man comes to the physician for a health maintenance examination. He has no personal or family history of major medical illnesses. He has never smoked cigarettes. Pulse oximetry on room air shows an oxygen saturation of 98%. Physical examination shows plethoric skin and splenomegaly. Laboratory studies show:

Hemoglobin 21.1 g/dL

Hematocrit 61%

Leukocyte count  $15,000/\text{mm}^3$

Segmented neutrophils 68%

Basophils 4%

Lymphocytes 28%

Platelet count  $501,000/\text{mm}^3$

Leukocyte alkaline phosphatase increased

A peripheral blood smear shows occasional giant platelets.

The primary hematologic defect in this patient most likely occurred in which of the following cells?

- (A) Erythroid progenitor
- (B) Hematopoietic stem
- (C) Lymphatic progenitor
- (D) Megakaryocyte progenitor
- (E) Pluripotent stem

**Correct Answer:**

(B) Hematopoietic stem

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The patient presents with Polycythemia Vera (PV), a chronic myeloproliferative neoplasm characterized by panmyelosis. The clinical findings include elevated hemoglobin/hematocrit (erythrocytosis), elevated leukocyte count (leukocytosis), and elevated platelet count (thrombocytosis), along with splenomegaly and a normal oxygen saturation (ruling out secondary polycythemia). The increased leukocyte alkaline phosphatase (LAP) score further supports a myeloproliferative process over a reactive one. PV is a clonal disorder caused by a mutation (most commonly  $JAK_2 V_{617}F$ ) in a hematopoietic stem cell. Because this stem cell is the common ancestor for the erythroid, myeloid (granulocytic), and megakaryocytic lineages, a mutation at this level results in the overproduction of all three cell lines. Option A and D are incorrect because they represent committed progenitors that would only result in the elevation of a single cell line. Option C is incorrect as the lymphoid lineage is typically not involved in the neoplastic proliferation of PV. Option E (Pluripotent stem) is often used in a broader biological context to refer to cells that can differentiate into any fetal or adult cell type (like embryonic stem cells); in the specific context of hematology, 'Hematopoietic stem cell' is the standard and most accurate term for the multipotent cell that gives rise to all blood components.

### Question 33.1

A 21-year-old man comes to the emergency department in the winter because of headache, nausea, and dizziness for 4 hours. He has not had fever, chills, or shortness of breath. He has no history of major medical illness. He lives in a basement apartment of a three-story house. He smokes 1½ packs of cigarettes daily. Physical examination shows no abnormalities. It is most appropriate for the physician to ask the patient for more information about which of the following historical factors?

- (A) Occupational exposure
- (B) Substance use
- (C) Travel
- (D) Type of home heating
- (E) Use of over-the-counter medication

**Correct Answer:**

- (D) Type of home heating

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The patient's presentation of headache, nausea, and dizziness in the winter, while living in a basement apartment, is highly suggestive of carbon monoxide (CO) poisoning. CO is a colorless, odorless gas produced by the incomplete combustion of carbon-containing fuels. In the winter, the use of space heaters, furnaces, and wood-burning stoves increases the risk of exposure, especially in poorly ventilated areas like basement apartments. The absence of fever and chills helps rule out common viral infections like influenza, which can present similarly. While the patient's smoking habit contributes to a baseline carboxyhemoglobin level, it would not typically cause acute symptoms of this nature. Therefore, the most critical historical factor to investigate is the type of home heating to identify a potential source of CO exposure. Other options such as travel, substance use, or occupational exposure are less likely given the specific seasonal and residential context provided.

### Question 35.1

A 25-year-old woman comes to the physician because of a long history of pain with menses. The pain occurs on the first day of her 5-day menstrual period and lasts all day. She rates the pain as 10 on a 10-point scale. The most appropriate initial pharmacotherapy to relieve this patient's pain has which of the following mechanisms of action?

- (A) Inhibition of estrogen synthesis
- (B) Inhibition of  $11\beta$ -hydroxylase activity
- (C) Inhibition of prostaglandin synthesis
- (D) Stimulation of follicle-stimulating hormone synthesis
- (E) Stimulation of luteinizing hormone synthesis

**Correct Answer:**

(C) Inhibition of prostaglandin synthesis

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The patient presents with classic symptoms of primary dysmenorrhea, characterized by recurrent, crampy lower abdominal pain occurring with the onset of menses in the absence of pelvic pathology. The pathophysiology of primary dysmenorrhea involves the release of prostaglandins (specifically  $\text{PGF}_{2\alpha}$  and  $\text{PGE}_2$ ) from the disintegrating endometrial cells during the transition to the menstrual phase. These prostaglandins cause potent myometrial contractions and vasoconstriction, leading to uterine ischemia and pain. The first-line pharmacologic treatment for primary dysmenorrhea is nonsteroidal anti-inflammatory drugs (NSAIDs). NSAIDs work by inhibiting the cyclooxygenase (COX) enzymes, which are responsible for the synthesis of prostaglandins from arachidonic acid. By reducing prostaglandin levels, NSAIDs decrease uterine hypercontractility and alleviate the associated pain. Inhibition of estrogen synthesis (A) or  $11\beta$ -hydroxylase (B) are not standard treatments for dysmenorrhea, and stimulation of FSH (D) or LH (E) would not address the underlying prostaglandin-mediated mechanism of menstrual cramping.

### Question 37.1

A 3800-g (8-lb 6-oz) newborn is delivered vaginally at 39 weeks' gestation after an uncomplicated pregnancy. Apgar scores are 9 and 9 at 1 and 5 minutes, respectively. The newborn is crying, has pink skin, and appears vigorous. Physical examination shows a vagina and also a structure that appears to be a penis, with the urethra located at the base near the opening of the vagina. Chromosomal analysis is ordered. Which of the following is the most likely cause of the intersex findings in this newborn if the karyotype is found to be 46,XX?

- (A)  $17\alpha$ -Hydroxyprogesterone deficiency
- (B) Increased concentration of müllerian-inhibiting substance
- (C) Maternal androgen exposure
- (D) Presence of the sex-determining region Y gene
- (E)  $5\alpha$ -Reductase deficiency

**Correct Answer:**

(C) Maternal androgen exposure

**Neural Consult Response and Explanation:**



**Answer:** C

**Explanation:** The clinical presentation describes a newborn with a 46,XX karyotype (chromosomally female) who exhibits virilization of the external genitalia (a phallic structure and a urethra at the base, indicating labioscrotal fusion). In a 46,XX individual, virilization occurs due to exposure to excess androgens during the critical window of external genital development (7–12 weeks gestation). Potential sources of these androgens include the fetal adrenal glands (e.g., 21-hydroxylase deficiency), the placenta (e.g., aromatase deficiency), or maternal sources (e.g., androgen-secreting ovarian or adrenal tumors, or exogenous androgenic medications). Option (C) is a recognized cause of 46,XX disorders of sex development (DSD). Option (A) is incorrect because 17 $\alpha$ -hydroxylase deficiency would lead to a decrease in androgen production, not an increase. Option (B) is incorrect because Müllerian-inhibiting substance (MIS) causes regression of internal female structures (uterus, tubes, upper vagina) but does not virilize external genitalia; furthermore, it is not typically present in 46,XX individuals. Option (D) is incorrect as the presence of the SRY gene on an X chromosome (translocation) would lead to testicular development, but the question specifies a 46,XX karyotype and the presence of a vagina, suggesting Müllerian structures are present. Option (E) is incorrect because 5 $\alpha$ -reductase deficiency affects 46,XY individuals, leading to undermasculinization due to the inability to convert testosterone to dihydrotestosterone.

### Question 38.1

A 65-year-old man is admitted to the hospital because of a 12-hour history of chest pain. Physical examination shows no abnormalities. Serum studies show an increased troponin I concentration. The diagnosis of myocardial infarction is made. It is suspected that this patient's condition deteriorated as a result of ischemia-reperfusion injury. The increased serum troponin I concentration in this patient most likely occurred as a result of which of the following processes?

- (A) Increased enzyme secretion
- (B) Increased enzyme synthesis
- (C) Karyolysis
- (D) Lysis of the endoplasmic reticulum
- (E) Lysis of the plasma membrane
- (F) Mitochondrial swelling

**Correct Answer:**

(E) Lysis of the plasma membrane

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** The patient has suffered a myocardial infarction (MI), which is characterized by myocardial necrosis. Troponin I is a structural protein located within the sarcomeres of cardiac myocytes. Under normal physiological conditions, the plasma membrane (sarcolemma) is impermeable to large intracellular proteins like troponin. However, during irreversible cell injury and necrosis—processes exacerbated by ischemia-reperfusion injury—the integrity of the plasma membrane is lost. This 'lysis' or disruption of the plasma membrane allows intracellular contents, including troponin I, to leak into the extracellular space and eventually into the systemic circulation, where they are detected by serum assays. Other options like mitochondrial swelling (F) and endoplasmic reticulum changes (D) occur during reversible injury or early stages of necrosis but do not directly account for the release of large proteins into the blood. Karyolysis (C) refers to nuclear fading and is a late sign of necrosis, but the specific mechanism for the release of cytoplasmic/structural proteins is the loss of the membrane barrier. Increased synthesis (B) or secretion (A) are not the mechanisms for troponin elevation in MI, as troponin is not a secreted hormone but a structural component released passively upon cell death.

### Question 39.1

A randomized clinical trial is conducted to compare wound healing and cosmetic differences between two surgical procedures for closing skin wounds following cesarean delivery. A total of 1000 women undergoing cesarean delivery during a 6-month period are enrolled in the study, which was 85% of the total number of patients undergoing the procedure. The results show a wound infection rate of 12 cases per 1000 women for Procedure A and 18 cases per 1000 women for Procedure B. Which of the following is the best estimate of the absolute risk reduction for wound infection following Procedure A compared with Procedure B?

- (A)  $(18/1000) - (12/1000)$
- (B)  $0.85 \times (12/1000)$
- (C)  $0.85 \times (18/1000)$
- (D)  $[0.85 \times (18/1000 - 12/1000)]$
- (E)  $[(1.2/100) - (1.8/100)] / (1.8/100)$

**Correct Answer:**

- (A)  $(18/1000) - (12/1000)$

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** Absolute Risk Reduction (ARR) is defined as the difference between the event rate in the control group (or comparison group) and the event rate in the experimental group. In this study, Procedure B resulted in 18 cases per 1000 (18/1000) and Procedure A resulted in 12 cases per 1000 (12/1000). Therefore, the ARR is calculated as (18/1000) - (12/1000), which equals 0.006 or 0.6%. Options B, C, and D are incorrect because the enrollment rate (85%) is a descriptive statistic regarding the study's recruitment efficiency but does not factor into the calculation of risk within the study population itself. Option E represents the formula for Relative Risk Reduction (RRR), which is calculated as (Control Rate - Experimental Rate) / Control Rate, rather than the Absolute Risk Reduction.

## Question 41.1

A 4-year-old girl with type 1 diabetes mellitus is brought to the emergency department by her father because of a 4-hour episode of restlessness, sweating, and confusion that occurred during the night. Yesterday, he allowed her to eat cupcakes and cotton candy at a county fair. At her bedtime that evening, he increased her dose of subcutaneous intermediate-acting and long-acting insulin. Her symptoms began 6 hours later, then resolved spontaneously. After being informed this morning of this nighttime episode, the mother insisted the father bring the patient to the hospital. On arrival, the patient is alert. Her vital signs are within normal limits. Examination shows no abnormalities. Her fingerstick blood glucose concentration is 72 mg/dL. Urinalysis is negative for glucose and ketones. Which of the following is the most likely explanation for this patient's nighttime symptoms?

- (A) Hyperglycemia caused by increased glucose consumption
- (B) Hyperglycemia caused by increased glycogen metabolism
- (C) Hyperglycemia caused by insufficient exogenous insulin
- (D) Hypoglycemia caused by excess exogenous insulin
- (E) Hypoglycemia caused by excessive renal glucose loss
- (F) Hypoglycemia caused by increased glucagon secretion
- (G) Nightmare disorder
- (H) Sleep terror disorder

**Correct Answer:**

(D) Hypoglycemia caused by excess exogenous insulin

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The clinical presentation is classic for nocturnal hypoglycemia. The patient, a 4-year-old with type 1 diabetes, experienced restlessness, sweating (autonomic/adrenergic symptom), and confusion (neuroglycopenic symptom) approximately 6 hours after receiving an increased dose of intermediate-acting and long-acting insulin. In type 1 diabetes, the most common cause of hypoglycemia is iatrogenic, specifically an excess of exogenous insulin relative to carbohydrate intake. Although the child consumed sugary foods earlier in the day, the father's decision to increase the basal (long-acting) and intermediate insulin doses at bedtime led to an insulin peak during the night when no glucose was being ingested, resulting in a drop in blood glucose levels. The spontaneous resolution of symptoms is explained by the body's counter-regulatory response (release of epinephrine, cortisol, and growth hormone), which mobilizes glucose from the liver. The current blood glucose of 72 mg/dL and the absence of ketones or glucose in the urine are consistent with a resolved hypoglycemic event. Options A, B, and C describe hyperglycemia, which would present with polyuria, polydipsia, and potentially ketoacidosis, not sweating and confusion that resolve spontaneously. Option E is incorrect as renal glucose loss occurs during hyperglycemia (exceeding the renal threshold). Option F is incorrect because glucagon secretion increases blood glucose and would prevent or treat hypoglycemia, not cause it. Options G and H (nightmares and sleep terrors) do not account for the specific history of insulin adjustment and the classic autonomic symptom of sweating in a diabetic patient.

### Question 43.1

A male newborn is delivered at term to a 28-year-old primigravid woman. Physical examination shows a broad, flat nose; low-set ears; a receding chin; prominent infraorbital folds; and bilateral abdominal masses. The newborn develops cyanosis, difficulty breathing, and polyuria and dies 24 hours after birth. At autopsy, examination shows pulmonary hypoplasia and enlarged, polycystic kidneys. Genetic testing shows two copies of a gene having a pathogenic mutation with a disease incidence rate in the general population of 1 in 10,000. Which of the following best describes the mutation occurrence rate for this newborn's disease?

- (A) 1/100
- (B) 1/400
- (C) 1/1000
- (D) 1/4000
- (E) 1/10,000

**Correct Answer:**

- (A) 1/100

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The clinical presentation describes a newborn with Potter sequence (Potter facies, pulmonary hypoplasia, and bilateral abdominal masses) caused by Autosomal Recessive Polycystic Kidney Disease (ARPKD). The autopsy findings of enlarged, polycystic kidneys and the genetic testing showing two copies of a pathogenic mutation confirm an autosomal recessive (AR) inheritance pattern. In population genetics, the Hardy-Weinberg equilibrium is used to relate allele frequencies to disease incidence. The disease incidence (the frequency of affected individuals, who must have two copies of the mutation) is represented by  $q^2$ . The question states the disease incidence is 1 in 10,000 ( $q^2 = 1/10,000$ ). The 'mutation occurrence rate' refers to the frequency of the pathogenic allele ( $q$ ) within the population's gene pool. To find  $q$ , we take the square root of the disease incidence:  $q = \sqrt{q^2} = \sqrt{1/10,000} = 1/100$ . Therefore, the frequency of the mutation in the population is 1/100. Other options such as 1/400 or 1/4000 do not mathematically align with the square root of the provided incidence, and 1/10,000 is the disease frequency ( $q^2$ ), not the allele frequency ( $q$ ).

## Question 45.1

A previously healthy 64-year-old man is brought to the emergency department 3 hours after the sudden onset of severe flank pain. He has no history of similar pain or serious illness. He takes no medications. He appears to be in distress. His pulse is 100/min, and blood pressure is 168/92 mm Hg. Physical examination shows a soft abdomen with left sided tenderness. Urinalysis shows microscopic hematuria. A CT scan of the abdomen shows a small ureteric calculus. Analgesic therapy is initiated and the pain resolves 1 hour later. The urine is then strained and a uric acid calculus is found. Which of the following processes is most likely impaired in this patient?

- (A) Bile salt metabolism
- (B) Cholesterol metabolism
- (C) Cytochrome P<sub>450</sub> activity
- (D) Purine metabolism
- (E) Urea cycle

**Correct Answer:**

(D) Purine metabolism

**Neural Consult Response and Explanation:**



**Answer: D**

**Explanation:** The patient presented with acute flank pain and hematuria, and the stone was identified as a uric acid calculus. Uric acid is the final metabolic breakdown product of purine metabolism in humans. Purines (adenine and guanine) are degraded into hypoxanthine and xanthine, which are then converted into uric acid by the enzyme xanthine oxidase. When there is an overproduction of uric acid (due to high purine intake or metabolic disorders) or, more commonly, a decrease in renal excretion or persistently acidic urine pH, uric acid precipitates to form stones. Bile salt and cholesterol metabolism (A and B) are related to gallstone formation, not urinary uric acid stones. Cytochrome P<sub>450</sub> activity (C) is involved in drug metabolism and is not a primary factor in stone formation. The urea cycle (E) is responsible for converting ammonia into urea for excretion; urea is a different nitrogenous waste product than uric acid and is highly soluble, not forming stones.

### Question 46.1

A 32-year-old woman with hypothyroidism comes to the physician because of a 6-week history of cold intolerance, constipation, and severe fatigue. She also has had a 4.5-kg (10-lb) weight gain during this period. Her current medication is daily levothyroxine. She also started taking calcium carbonate supplements 2 months ago for osteopenia of the lumbar spine. At that time, serum concentrations of thyroid-stimulating hormone (TSH) and free thyroxine (FT<sub>4</sub>) were within the reference ranges. Today, physical examination shows coarse, dry skin. Serum studies show a TSH concentration of 16.6  $\mu$ U/mL and FT<sub>4</sub> concentration of 0.3 ng/dL. Which of the following pharmacokinetic changes of levothyroxine is the most likely cause of this patient's current condition?

- (A) Decreased absorption
- (B) Decreased distribution
- (C) Decreased elimination
- (D) Increased distribution
- (E) Increased elimination
- (F) Increased metabolism

**Correct Answer:**

- (A) Decreased absorption

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient presents with clinical and biochemical evidence of hypothyroidism (elevated TSH and low FT<sub>4</sub>) despite being on a stable dose of levothyroxine. The timeline of her symptom onset correlates with the initiation of calcium carbonate supplements two months ago. Levothyroxine is primarily absorbed in the duodenum and jejunum, and its absorption is highly sensitive to the gastric pH and the presence of other substances. Calcium carbonate is a well-known interfering agent that binds to levothyroxine in the gastrointestinal tract, forming insoluble complexes that prevent the hormone from being absorbed into the bloodstream. This leads to decreased bioavailability of the medication, resulting in a return to a hypothyroid state. To avoid this interaction, patients are typically advised to separate the administration of levothyroxine and calcium supplements by at least four hours. Other options such as changes in distribution, elimination, or metabolism are incorrect because calcium carbonate does not significantly alter the protein binding (TBG), renal clearance, or hepatic cytochrome P<sub>450</sub> metabolism of levothyroxine.

## Question 48.1

A 19-year-old man undergoes splenectomy because of crush injuries sustained in a motor vehicle collision. During the operation, two small accessory spleens are seen adjacent to the ruptured spleen. The most likely origin of this patient's congenital anomaly is thickening of an embryologic layer at which of the following sites?

- (A) Adjacent to the ventral pancreas
- (B) Along the lesser curvature of the stomach
- (C) At the origin of the celiac vessels
- (D) In a portion of the hepatic diverticulum
- (E) Within the dorsal mesogastrium

**Correct Answer:**

- (E) Within the dorsal mesogastrium

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** The spleen is unique among the abdominal organs in that it is derived from the mesoderm rather than the endoderm of the primitive gut tube. It begins development during the 5th week of gestation as a collection of mesenchymal cells that proliferate and thicken within the dorsal mesogastrium (the mesentery of the stomach). During normal development, multiple splenic nodules form and subsequently fuse to create the adult spleen. If these nodules fail to fuse completely, accessory spleens (splenules) develop. These are most commonly found near the splenic hilum or within the gastrosplenic ligament, both of which are derivatives of the dorsal mesogastrium. Option A is incorrect as the ventral pancreas develops from the ventral bud of the foregut endoderm. Option B is incorrect as the lesser curvature is associated with the ventral mesogastrium (which becomes the lesser omentum). Option C is incorrect as the celiac trunk is the artery of the foregut but not the site of splenic thickening. Option D is incorrect as the hepatic diverticulum gives rise to the liver, gallbladder, and biliary tree.

## Question 49.1

A 48-year-old man comes to the physician requesting treatment for alcohol withdrawal. He reports a 30-year history of consuming 6 to 10 beers daily. He has had two citations for driving while intoxicated. He has previously experienced alcohol-associated seizures and withdrawal symptoms. His vital signs are within normal limits. Physical examination shows palmar erythema. The most appropriate pharmacotherapy in this patient most likely has which of the following mechanisms?

- (A) Blockade of dopamine receptors
- (B) Decreased activity of dopamine transporters
- (C) Enhancement of the effect of postsynaptic  $\gamma$ -aminobutyric acid (GABA)
- (D) Increased GABA transaminase activity
- (E) Inhibition of glutamate release
- (F) Inhibition of serotonin reuptake
- (G) Opening of glutamate channels
- (H) Stimulation of 5-hydroxytryptophan receptors

**Correct Answer:**

- (C) Enhancement of the effect of postsynaptic  $\gamma$ -aminobutyric acid (GABA)

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The patient is presenting with a high risk for severe alcohol withdrawal syndrome (AWS), given his 30-year history of heavy alcohol use and prior history of alcohol-associated seizures. The standard of care for the management of acute alcohol withdrawal is the administration of benzodiazepines. Chronic alcohol consumption leads to the downregulation of GABA-A receptors and the upregulation of NMDA (glutamate) receptors to maintain homeostasis in the presence of a CNS depressant. When alcohol is abruptly stopped, the lack of GABAergic tone and the excess of glutamatergic activity lead to CNS hyperexcitability. Benzodiazepines act as positive allosteric modulators of the GABA-A receptor; they bind to a specific site on the receptor complex and increase the frequency of chloride channel opening in response to GABA. This enhances the inhibitory effect of postsynaptic GABA, thereby stabilizing the neuronal membranes and preventing seizures and delirium tremens. While the patient's palmar erythema suggests chronic liver disease (which might lead a clinician to choose 'LOT' benzodiazepines—Lorazepam, Oxazepam, or Temazepam—due to their metabolism via glucuronidation rather than the cytochrome P<sub>450</sub> system), the fundamental mechanism of action remains the enhancement of GABAergic activity.

## Question 50.1

A 48-year-old woman with type 2 diabetes mellitus comes to the physician for a follow-up examination. Current medications are metformin and once-daily insulin. She travels frequently and works long hours. She says that her meals are usually fast food. She leads a sedentary lifestyle. She often forgets to measure her blood glucose concentration. Her last hemoglobin A<sub>1c</sub> was measured as 8.4%. Which of the following is the most appropriate action by the physician to help this patient improve her diabetic control?

- (A) Create an exercise regimen for the patient
- (B) Explore barriers to diet adherence
- (C) Increase the patient's insulin dosage
- (D) Increase the patient's metformin dosage
- (E) Measure the patient's blood glucose concentration
- (F) Order measurement of the patient's microalbumin concentration
- (G) Refer the patient to a nutritionist

**Correct Answer:**

- (B) Explore barriers to diet adherence

**Neural Consult Response and Explanation:**



**Answer:** B

**Explanation:** The patient presents with poorly controlled type 2 diabetes mellitus (HbA<sub>1c</sub> 8.4%) despite being on a regimen of metformin and insulin. The clinical vignette highlights several behavioral and lifestyle challenges: a high-stress job with long hours, frequent travel, a diet consisting primarily of fast food, a sedentary lifestyle, and poor adherence to self-monitoring of blood glucose. In the management of type 2 diabetes, lifestyle modification is the cornerstone of therapy. Before escalating pharmacologic treatment (Options C and D) or prescribing specific regimens (Option A), the physician must employ a patient-centered approach to understand why the patient is struggling to adhere to the current plan. Exploring barriers to diet adherence (Option B) allows the physician to identify the specific obstacles—such as time constraints, travel-related food availability, or lack of nutritional knowledge—that prevent the patient from following a healthy diet. This collaborative step is essential for developing a realistic and sustainable management plan. While referral to a nutritionist (Option G) is beneficial, the physician's immediate role in a follow-up visit is to assess the patient's readiness and specific hurdles to change. Options E and F are diagnostic or monitoring steps that do not address the underlying cause of poor glycemic control.

## Question 51.1

A 19-year-old man who is a college freshman comes to the office because of a 4-day history of tender, swollen glands. He also has a 6-day history of fever, malaise, and decreased appetite. His temperature is 38.7°C (101.7°F). Physical examination shows swelling of the parotid glands. Which of the following infectious agents is the most likely cause of these findings?

- (A) Epstein-Barr virus
- (B) Hepatitis B virus
- (C) Measles virus
- (D) Mumps virus
- (E) Rubella virus

**Correct Answer:**

- (D) Mumps virus

**Neural Consult Response and Explanation:**



**Answer: D**

**Explanation:** The clinical presentation of fever, malaise, and anorexia (prodrome) followed by tender, swollen parotid glands (parotitis) in a college-aged individual is classic for the mumps virus. Mumps is a paramyxovirus that primarily affects the salivary glands. While vaccination has reduced its incidence, outbreaks frequently occur in high-density living environments like college dormitories due to waning immunity or close contact. (A) Epstein-Barr virus (EBV) typically presents with the triad of fever, pharyngitis, and posterior cervical lymphadenopathy, often accompanied by splenomegaly; it does not typically cause parotitis. (B) Hepatitis B virus presents with jaundice, abdominal pain, and constitutional symptoms, but not parotid swelling. (C) Measles virus presents with the '3 Cs' (cough, coryza, conjunctivitis), Koplik spots, and a maculopapular rash starting on the face and spreading downward. (E) Rubella virus presents with a milder rash and postauricular or suboccipital lymphadenopathy, rather than parotid enlargement.

## Question 52.1

A 38-year-old woman who is a veteran comes to the emergency department because of a 4-hour history of a sensation of tightness in her throat and swelling of her face, lips, and tongue. She has not had itching. During the past 3 weeks, she has had two similar, milder episodes that resolved without treatment within 24 to 72 hours. Six weeks ago, she began treatment with an ACE inhibitor for hypertension. She has seasonal allergies. Her temperature is 37.1°C (98.8°F), pulse is 80/min, respirations are 20/min, and blood pressure is 138/81 mm Hg. Physical examination shows angioedema of the lips and tongue. There is no evidence of urticaria. Which of the following is the most likely cause of the angioedema in this patient?

- (A) Bradykinin
- (B) Histamine
- (C) Leukotriene B<sub>4</sub>
- (D) Nitric oxide
- (E) Prostaglandin E<sub>2</sub>

**Correct Answer:**

(A) Bradykinin

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient presents with angioedema (swelling of the lips, tongue, and face) without associated urticaria (hives) or pruritus (itching). The key clinical detail is the initiation of an ACE inhibitor six weeks prior. ACE inhibitors work by inhibiting the angiotensin-converting enzyme, which is also known as kininase II. Kininase II is responsible for the degradation of bradykinin. When this enzyme is inhibited, bradykinin levels increase. Bradykinin is a potent vasodilator that increases vascular permeability, leading to the extravasation of fluid into the interstitium and resulting in angioedema. Unlike histamine-mediated angioedema (which is typically seen in IgE-mediated allergic reactions), bradykinin-mediated angioedema is characteristically not associated with itching or hives. Histamine (B) would be the primary mediator if the patient had urticaria and itching. Leukotrienes (C), Nitric Oxide (D), and Prostaglandins (E) are involved in various inflammatory pathways and vasodilation, but they are not the specific mediators responsible for ACE inhibitor-induced angioedema.

## Question 54.1

A 48-year-old woman comes to the physician because of a 2-month history of fatigue and poor appetite; she has had a 3-kg (6.6-lb) weight loss during this period. Abdominal examination shows moderate splenomegaly. Laboratory studies show a leukocyte count of  $185,000/\text{mm}^3$  (65% segmented neutrophils with 6% blasts and promyelocytes). Cytogenetic analysis of a bone marrow aspirate shows the presence of the Philadelphia ( $\text{Ph}^1$ ) chromosome in myelocytes. Which of the following mechanisms best accounts for the formation of the Philadelphia ( $\text{Ph}^1$ ) chromosome in this patient?

- (A) Nondisjunction
- (B) Recombination
- (C) Sister chromatid exchange
- (D) Telomere breakage
- (E) Transposon insertion

**Correct Answer:**

(B) Recombination

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The patient presents with classic features of Chronic Myeloid Leukemia (CML), including massive leukocytosis, splenomegaly, and the presence of the Philadelphia chromosome (Ph<sup>1</sup>). The Philadelphia chromosome is the result of a reciprocal translocation between chromosomes 9 and 22, specifically t(9;22)(q34;q11). This translocation involves the breakage of DNA on two non-homologous chromosomes and the subsequent rejoining of the segments in a new arrangement, resulting in the BCR-ABL<sub>1</sub> fusion gene. In the context of genetics, the process of breaking and rejoining DNA strands to produce new combinations of genetic material is defined as recombination (specifically, non-homologous or illegitimate recombination in this pathological context). (A) Nondisjunction results in aneuploidy (e.g., Trisomy 21) due to failure of separation during meiosis or mitosis. (C) Sister chromatid exchange involves the swap of material between identical chromatids of the same chromosome, which does not result in new genetic combinations or translocations. (D) Telomere breakage can lead to instability but is not the specific mechanism of the t(9;22) translocation. (E) Transposon insertion involves 'jumping genes' moving to new locations, which is not the cause of the Philadelphia chromosome.

## Question 55.1

A 2-year-old boy is brought to the physician because of failure to thrive. He also has had loose, fatty, foul-smelling stools and a cough during the past 2 weeks. He is at the 30th percentile for height and 10th percentile for weight. Physical examination shows no other abnormalities. Laboratory studies show steatorrhea and a sweat chloride concentration of 80 mmol/L. A chest x-ray shows hyperinflation. Sputum culture grows *Haemophilus influenzae* and *Staphylococcus aureus*. Secretion of which of the following substances is most likely to be decreased in this patient?

- (A) Bicarbonate
- (B) Gastric acid
- (C) Glucagon
- (D) Insulin
- (E) Intrinsic factor

**Correct Answer:**

- (A) Bicarbonate

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient presents with classic signs of Cystic Fibrosis (CF), including failure to thrive, steatorrhea (fatty stools), chronic respiratory symptoms (cough, hyperinflation, and infection with *H. influenzae* and *S. aureus*), and a diagnostic sweat chloride concentration of 80 mmol/L (normal < 40 mmol/L, diagnostic > 60 mmol/L). CF is caused by a mutation in the CFTR gene, which encodes a cAMP-regulated chloride and bicarbonate channel. In the pancreas, CFTR is essential for the secretion of bicarbonate and water by the ductal cells. This bicarbonate-rich fluid is necessary to flush proenzymes into the duodenum and neutralize gastric acid to provide an optimal pH for digestive enzymes. In CF, the lack of bicarbonate secretion leads to thick, acidic secretions that obstruct the pancreatic ducts, causing secondary atrophy of the exocrine pancreas and subsequent malabsorption. While endocrine dysfunction (insulin/glucagon deficiency) can occur later in life due to progressive pancreatic scarring (Cystic Fibrosis-Related Diabetes), the primary and most direct secretory defect involving the CFTR channel in the exocrine pancreas is the secretion of bicarbonate. Gastric acid and intrinsic factor are products of gastric parietal cells and are not affected by CFTR mutations.

## Question 57.1

A 10-year-old boy is brought to the physician because of a 3-week history of nosebleeds and easy bruisability. His older brother has had similar episodes. He is at the 30th percentile for height and weight. Physical examination shows nasal and gingival bleeding and several ecchymoses over the trunk and upper and lower extremities in various stages of healing. Laboratory studies show a platelet count of  $300,000/\text{mm}^3$  (N=150,000–400,000). Platelet adhesion testing shows a normal response to ristocetin, but aggregation does not occur in response to thrombin; platelet morphology is normal. Prothrombin time and activated partial thromboplastin time are within the reference ranges. A defect in which of the following is the most likely cause of the findings in this patient?

- (A) Factor VII (proconvertin)
- (B) Fibrinogen
- (C) Glycoprotein IIb-IIIa
- (D) Granule storage pool
- (E) von Willebrand factor

**Correct Answer:**

- (C) Glycoprotein IIb-IIIa

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The clinical presentation of mucocutaneous bleeding (epistaxis, gingival bleeding, ecchymoses) in a 10-year-old boy with a positive family history suggests an inherited disorder of primary hemostasis. The laboratory findings are the key to differentiating the specific defect: 1) The platelet count is normal ( $300,000/\text{mm}^3$ ), which rules out thrombocytopenia and Bernard-Soulier syndrome (which typically presents with macrothrombocytopenia). 2) PT and aPTT are normal, ruling out disorders of the coagulation cascade (secondary hemostasis), such as Factor VII deficiency or significant fibrinogen deficiency. 3) Platelet adhesion testing with ristocetin is normal, which confirms that the interaction between von Willebrand factor (vWF) and the Glycoprotein Ib-IX-V receptor is intact, ruling out von Willebrand disease and Bernard-Soulier syndrome. 4) The failure of platelets to aggregate in response to thrombin (a potent platelet agonist) indicates a defect in the final common pathway of platelet aggregation. This pathway requires the Glycoprotein IIb-IIIa receptor to undergo a conformational change and bind fibrinogen to form bridges between adjacent platelets. A deficiency or defect in Glycoprotein IIb-IIIa is the hallmark of Glanzmann thrombasthenia, which perfectly matches this patient's profile of normal count, normal adhesion, but absent aggregation.

## Question 58.1

A previously healthy 45-year-old woman who works as a park ranger comes to the physician because of a 1-week history of shortness of breath, even at rest. She has lived in the mountains at 10,000 feet above sea level for 2 years; the physician's office is located at sea level. Her pulse is 85/min, respirations are 18/min, and blood pressure is 125/90 mm Hg. Physical examination while sitting upright shows jugular venous distention and 2+ pedal edema. During the past 2 years, which of the following has most likely decreased in this patient?

- (A) Height of P waves in lead I of the patient's ECG
- (B) Height of R waves in lead  $V_1$  of the patient's ECG
- (C) Hematocrit
- (D) Pulmonary vascular resistance
- (E) Right ventricular diastolic compliance
- (F) Right ventricular wall thickness

**Correct Answer:**

- (E) Right ventricular diastolic compliance

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** The patient is presenting with signs of right-sided heart failure (jugular venous distention, pedal edema, and dyspnea) after living at a high altitude (10,000 feet) for two years. At high altitudes, the low partial pressure of oxygen (hypoxia) triggers chronic hypoxic pulmonary vasoconstriction. This leads to a sustained increase in pulmonary vascular resistance (PVR) and pulmonary hypertension. In response to the chronic pressure overload (increased afterload), the right ventricle (RV) undergoes compensatory concentric hypertrophy to maintain stroke volume. As the RV wall thickens (increasing RV wall thickness), the ventricle becomes stiffer and less distensible, which is defined as a decrease in right ventricular diastolic compliance. Regarding the other options: (A) and (B) are incorrect because right heart strain and hypertrophy typically increase the height of P waves in inferior leads and R waves in  $V_1$ ; (C) is incorrect because chronic hypoxia stimulates erythropoietin production, increasing hematocrit; (D) is incorrect because PVR increases due to hypoxic vasoconstriction; and (F) is incorrect because the RV wall thickness increases as a compensatory mechanism for the increased afterload.

## Question 59.1

A 25-year-old woman comes to the physician because of a 4-month history of cough and unintentional weight loss. Rhonchi are heard posteriorly over the right upper thorax. A chest x-ray shows an 8-cm cavity in the right upper lobe and hilar lymphadenopathy. Ziehl-Neelsen staining of an induced sputum specimen shows acid-fast bacilli. The patient begins treatment with four antimycobacterial drugs, including rifampin. Synthesis of which of the following components of the suspected pathogen is most likely directly inhibited by the rifampin in this patient's medication regimen?

- (A) ATP
- (B) Folic acid
- (C) Peptidoglycan
- (D) Protein
- (E) RNA

**Correct Answer:**

(E) RNA

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** The patient's clinical presentation (weight loss, cough, upper lobe cavitory lesion, and hilar lymphadenopathy) combined with the presence of acid-fast bacilli on Ziehl-Neelsen staining is diagnostic of active pulmonary tuberculosis caused by *Mycobacterium tuberculosis*. The standard initial treatment regimen consists of four drugs: isoniazid, rifampin, pyrazinamide, and ethambutol (RIPE). The question specifically asks for the mechanism of rifampin. Rifampin works by binding to and inhibiting the bacterial DNA-dependent RNA polymerase. This enzyme is responsible for the transcription of DNA into RNA. By blocking this enzyme, rifampin directly inhibits the synthesis of RNA. Other options are incorrect because: (A) ATP synthesis is inhibited by bedaquiline; (B) Folic acid synthesis is inhibited by sulfonamides; (C) Peptidoglycan or cell wall synthesis is targeted by drugs like isoniazid (mycolic acid) or ethambutol (arabinosyltransferase), but not rifampin; (D) Protein synthesis is inhibited by aminoglycosides like streptomycin, which bind to the 30S ribosomal subunit.

## Question 60.1

A 34-year-old man is brought to the emergency department 30 minutes after being hit by a motor vehicle while walking. His temperature is 36°C (96.8°F), pulse is 140/min, respirations are 24/min, and blood pressure is 90/60 mm Hg. During an exploratory laparotomy, a large laceration is found that includes the right and left lobes of the liver. Active bleeding is present. Compression of which of the following ligaments is most likely to decrease bleeding from the liver in this patient?

- (A) Coronary
- (B) Falciform
- (C) Gastrohepatic
- (D) Hepatoduodenal
- (E) Triangular

**Correct Answer:**

- (D) Hepatoduodenal

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The patient is presenting with hemorrhagic shock (hypotension, tachycardia) due to a severe liver laceration following blunt abdominal trauma. In the setting of an exploratory laparotomy for active hepatic bleeding, the Pringle maneuver is a standard surgical technique used to control hemorrhage. This maneuver involves compressing the hepatoduodenal ligament, which contains the portal triad: the hepatic artery proper, the portal vein, and the common bile duct. By occluding the hepatic artery and portal vein, the inflow of blood to the liver is temporarily halted, allowing the surgeon to identify and repair the source of bleeding. The other ligaments listed do not contain the primary vascular supply to the liver. The coronary and triangular ligaments are peritoneal reflections that attach the liver to the diaphragm; the falciform ligament attaches the liver to the anterior abdominal wall and contains the ligamentum teres; and the gastrohepatic ligament (part of the lesser omentum) connects the liver to the lesser curvature of the stomach but does not house the main portal inflow vessels.

## Question 61.1

A 1-month-old boy is brought to the emergency department because of a 1-day history of fever and cough. His temperature is 38.2°C (100.8°F), pulse is 140/min, and respirations are 54/min. Physical examination shows intercostal retractions. Wheezes are heard in all lung fields. A blood culture grows coagulase-negative, catalase-positive, gram-positive cocci in clusters. Which of the following best represents the infectious agent in this patient's blood culture?

- (A) *Staphylococcus aureus*, contaminant
- (B) *Staphylococcus aureus*, pathogen
- (C) *Staphylococcus epidermidis*, contaminant
- (D) *Staphylococcus epidermidis*, pathogen
- (E) *Streptococcus pneumoniae*, contaminant
- (F) *Streptococcus pneumoniae*, pathogen
- (G) *Streptococcus sanguis*, contaminant
- (H) *Streptococcus sanguis*, pathogen

**Correct Answer:**

(C) *Staphylococcus epidermidis*, contaminant

**Neural Consult Response and Explanation:**



**Answer:** C

**Explanation:** The microbiological description provided is characteristic of Coagulase-negative Staphylococci (CoNS). Specifically, Gram-positive cocci in clusters that are catalase-positive and coagulase-negative identify the organism as a member of the CoNS group, of which Staphylococcus epidermidis is the most common species. This eliminates options A, B, E, F, G, and H. The clinical challenge is determining if the isolate is a pathogen or a contaminant. The patient presents with classic symptoms of bronchiolitis (fever, cough, wheezing, and intercostal retractions), which is almost exclusively a viral illness in a 1-month-old (most commonly caused by Respiratory Syncytial Virus). Staphylococcus epidermidis is a ubiquitous component of the normal skin flora and is the most frequent contaminant of blood cultures. In an infant with a clear viral respiratory syndrome and no indwelling foreign bodies (like a central venous catheter), a single blood culture growing CoNS is highly likely to be a contaminant. Therefore, Staphylococcus epidermidis, contaminant, is the most accurate representation.

### Question 63.1

A new drug, Drug X, is being investigated to determine its pharmacokinetic properties in humans. A male participant who weighs 85 kg (187 lb) with 50 L of total body water begins treatment with an intravenous infusion of Drug X at the rate of 100 mg/h. This drug is known to distribute in total body water. The plasma concentrations of the drug are measured. Results show that the steady-state plasma concentration of Drug X is 50 mg/L. Based on this information, which of the following is the clearance rate of this drug in this man?

- (A) 20 mg/h
- (B) 100 mg/h
- (C) 0.22 L/h
- (D) 2 L/h
- (E) 22 L/h

**Correct Answer:**

- (D) 2 L/h

### Neural Consult Response and Explanation:

**Answer:** D

**Explanation:** To determine the clearance (CL) of a drug during a continuous intravenous infusion, the formula for steady-state concentration ( $C_{ss}$ ) is used:  $C_{ss} = \text{Infusion Rate} / \text{CL}$ . Rearranging this formula to solve for clearance gives:  $\text{CL} = \text{Infusion Rate} / C_{ss}$ . In this scenario, the infusion rate is 100 mg/h and the measured steady-state plasma concentration is 50 mg/L. Plugging these values into the equation:  $\text{CL} = 100 \text{ mg/h} / 50 \text{ mg/L} = 2 \text{ L/h}$ . Other information provided in the prompt, such as the participant's weight (85 kg) and total body water (50 L), is used to calculate the volume of distribution ( $V_d$ ) or half-life, but is not required to calculate the clearance when the infusion rate and steady-state concentration are already known. Therefore, 2 L/h is the correct clearance rate.



---

## Question 64.1

A 78-year-old woman is admitted to the intensive care unit because of diverticulitis complicated by *Escherichia coli* sepsis. Treatment with ciprofloxacin is started. Three days later, her serum creatinine concentration has increased from 0.7 mg/dL on admission to 1.3 mg/dL. Urinalysis shows muddy brown casts. The most likely cause of the findings in this patient is ischemia of which of the following structures?

- (A) Bowman capsule
- (B) Glomerulus
- (C) Interstitium
- (D) Proximal tubule
- (E) Renal vein

### Correct Answer:

- (D) Proximal tubule

### Neural Consult Response and Explanation:

**Answer:** D

**Explanation:** The clinical presentation describes a patient with sepsis-induced Acute Kidney Injury (AKI). The presence of 'muddy brown casts' on urinalysis is the pathognomonic finding for Acute Tubular Necrosis (ATN). ATN occurs due to either nephrotoxic injury or, as in this case of sepsis and potential hypotension, ischemic injury. The renal tubules are highly metabolic and require significant oxygen for active transport processes. Specifically, the proximal tubule and the thick ascending limb of the loop of Henle are the most metabolically active and thus the most susceptible to ischemic damage. When these epithelial cells undergo necrosis and slough off into the tubular lumen, they form the characteristic granular, muddy brown casts seen in the urine. Other options are incorrect because: (A) and (B) involve glomerular pathology, which typically presents with hematuria and red blood cell casts; (C) involves the interstitium, where injury (Acute Interstitial Nephritis) typically presents with white blood cell casts and eosinophils; and (E) renal vein thrombosis would present with flank pain and hematuria rather than the classic casts of ATN.

---

## Question 65.1

A 34-year-old woman with myasthenia gravis comes to the emergency department because of a 2-day history of increasing weakness, shortness of breath, and abdominal cramping. Current medications are prednisone and pyridostigmine. Her temperature is 37°C (98.6°F), pulse is 45/min, and respirations are 25/min and shallow. Her voice is soft and hypernasal, and she coughs weakly when swallowing water. Breath and heart sounds are normal. Pulmonary testing shows inability to



generate a normal negative inspiratory force during forced inspiration. The abdomen is soft and nontender, with increased bowel sounds. Muscle strength is 4/5 diffusely, with severe, continuous, and diffuse fasciculations. Deep tendon reflexes are sluggish, but symmetric. Which of the following is the most likely cause of this patient's weakness?

- (A) Aspiration pneumonia
- (B) Guillain-Barré syndrome
- (C) Insufficient dose of prednisone
- (D) Motor neuron disease
- (E) Pyridostigmine overdose

**Correct Answer:**

- (E) Pyridostigmine overdose

**Neural Consult Response and Explanation:**

**Answer:** E

**Explanation:** The patient is presenting with a cholinergic crisis, which is caused by an overdose of acetylcholinesterase inhibitors like pyridostigmine. In patients with myasthenia gravis, it can be clinically difficult to distinguish between a myasthenic crisis (too little medication/worsening disease) and a cholinergic crisis (too much medication), as both present with profound muscle weakness and respiratory failure. However, the presence of 'SLUDGE' (Salivation, Lacrimation, Urination, Defecation, GI distress, Emesis) and nicotinic symptoms points toward cholinergic excess. Specifically, this patient has bradycardia (pulse 45/min), abdominal cramping with increased bowel sounds (GI distress), and diffuse fasciculations. Fasciculations occur because excess acetylcholine at the neuromuscular junction causes persistent depolarization of the muscle membrane. In contrast, a myasthenic crisis would not present with bradycardia or fasciculations; it would typically present with tachycardia and an absence of these muscarinic/nicotinic overstimulation signs. Aspiration pneumonia (A) might complicate the clinical picture but doesn't explain the bradycardia and fasciculations. Guillain-Barré (B) and Motor neuron disease (D) are inconsistent with the known diagnosis of MG and the acute cholinergic symptoms. Insufficient prednisone (C) would lead to a myasthenic crisis, not a cholinergic one.

**Question 66.1**

A 35-year-old woman comes to the office because she has had three first-trimester spontaneous abortions during the past 3 years. Physical examination shows no abnormalities. Laboratory studies show no endocrine abnormalities. Chromosomal analysis shows a paracentric inversion of the long arm of chromosome 1. Which of the following best describes this patient's risk for early spontaneous abortions and a liveborn child with aneuploidy?

- (A) High Risk for Early Spontaneous Abortions: high Risk for Liveborn Child With Aneuploidy
- (B) High Risk for Early Spontaneous Abortions: low Risk for Liveborn Child With Aneuploidy
- (C) Low Risk for Early Spontaneous Abortions: high Risk for Liveborn Child With Aneuploidy
- (D) Low Risk for Early Spontaneous Abortions: low Risk for Liveborn Child With Aneuploidy



### Correct Answer:

(B) High Risk for Early Spontaneous Abortions: low Risk for Liveborn Child With Aneuploidy

### Neural Consult Response and Explanation:

**Answer:** B

**Explanation:** The patient has a paracentric inversion, which is a chromosomal rearrangement where a segment of a chromosome arm is flipped 180 degrees, not involving the centromere. During meiosis, if a crossover event occurs within the inversion loop of a paracentric inversion, it results in the formation of dicentric (two centromeres) and acentric (no centromere) chromosomes. These are highly unstable and lead to significant loss or gain of genetic material. Because these imbalances are so severe, the resulting embryos are typically non-viable and result in early spontaneous abortions, explaining the patient's history of three first-trimester losses (High Risk for Early Spontaneous Abortions). Conversely, because these specific types of unbalanced gametes are almost universally lethal in utero, it is extremely rare for such a pregnancy to progress to term. Therefore, the risk of a liveborn child with aneuploidy is very low (Low Risk for Liveborn Child With Aneuploidy). This contrasts with pericentric inversions (involving the centromere), which can produce unbalanced but stable monocentric chromosomes that are more likely to result in viable, though affected, live births.

### Question 67.1

A 12-year-old boy is brought to the office by his parents for genetic counseling because of a family history of genetic disorders. He has no symptoms or history of major medical illness. The patient's maternal grandfather died of Huntington disease at the age of 35 years. Genetic testing of the mother showed 19 triplet repeats on each huntingtin (HTT) allele (N=10–20). The patient's paternal grandfather had colon cancer at the age of 30 years, and the father had numerous colon polyps at the age of 20 years treated with a colectomy. Genetic testing of the father shows heterozygosity for a frame-shift mutation in the APC gene. Physical examination of the patient shows abnormalities. Based on this patient's risk for genetic disease, it is most appropriate for the physician to order which of the following genetic tests at this time?

- (A) Analysis of triplet repeat sizes of HTT
- (B) Full sequencing and rearrangement analysis of APC
- (C) Full sequencing of HTT
- (D) Specific testing for the APC frame-shift mutation
- (E) It is not recommended to do predictive genetic testing on a minor

### Correct Answer:

(D) Specific testing for the APC frame-shift mutation

### Neural Consult Response and Explanation:



**Answer:** D

**Explanation:** The patient's risk for genetic disease must be evaluated for both Huntington disease (HD) and Familial Adenomatous Polyposis (FAP). Regarding HD, the patient's maternal grandfather was affected, but his mother's genetic testing showed 19 triplet repeats on each HTT allele. Since the normal range is 10–20 repeats, the mother does not carry the mutation and cannot pass it to her son; therefore, testing the son for HD (options A and C) is unnecessary. Regarding FAP, the father has a confirmed frame-shift mutation in the APC gene, an autosomal dominant condition. The son has a 50% risk of inheritance. While genetic testing of minors for adult-onset conditions is generally deferred, FAP is a critical exception because clinical surveillance (e.g., annual sigmoidoscopy) must begin in early adolescence (typically ages 10–12) to prevent colorectal cancer. Since the specific pathogenic mutation in the family is already known (the father's frame-shift mutation), the most appropriate and cost-effective test is targeted testing for that specific mutation (D), rather than full sequencing (B). Option E is incorrect because the medical benefit of early screening in FAP justifies testing a minor.

## Question 69.1

A 25-year-old man comes to the office because of a 4-hour history of irritability, restlessness, tremor, and palpitations. He is a known user of amphetamines. His pulse is 120/min, respirations are 25/min, and blood pressure is 150/100 mm Hg. Physical examination shows no abnormalities. The most likely cause of this patient's symptoms is sympathomimetic activity arising from which of the following?

- (A) Decreased intracellular metabolism of biogenic amines
- (B) Decreased monoamine oxidase activity
- (C) Decreased presynaptic receptor activation
- (D) Increased intracellular metabolism of biogenic amines
- (E) Increased presynaptic receptor activation
- (F) Increased release of biogenic amines

**Correct Answer:**

- (F) Increased release of biogenic amines

**Neural Consult Response and Explanation:**



**Answer:** F

**Explanation:** The patient presents with classic signs of acute amphetamine intoxication, characterized by a sympathomimetic toxidrome (tachycardia, hypertension, restlessness, and tremors). Amphetamines exert their effects by significantly increasing the synaptic concentrations of biogenic amines, specifically norepinephrine, dopamine, and serotonin. The primary mechanism involves the drug being taken up into the presynaptic nerve terminal via reuptake transporters (like the dopamine transporter, DAT). Once inside, amphetamines displace these neurotransmitters from their storage vesicles into the cytoplasm and subsequently induce the reverse transport of these amines through the transporters into the synaptic cleft. This results in a massive 'increased release of biogenic amines' into the synapse, leading to overstimulation of the sympathetic nervous system. While amphetamines also inhibit reuptake and monoamine oxidase to a lesser extent, the hallmark of their action compared to other stimulants like cocaine is the active induction of neurotransmitter release.

## Question 70.1

A 5-year-old girl is brought to the office by her mother because of a 6-hour history of bloody diarrhea. She is interactive and in no acute distress. Her blood pressure is 90/55 mm Hg. Abdominal examination shows normoactive bowel sounds. Stool cultures are obtained, and the patient's mother is advised to give the girl plenty of fluids. Five days later, the patient develops decreased urine output and is brought back to the office. Her blood pressure is now 135/88 mm Hg. Physical examination shows pallor. Laboratory studies show:

Hemoglobin 8.5 g/dL (N=11–15) Hematocrit 26% (N=28%–45%) Platelet count 45,000/mm<sup>3</sup> (N=150,000–400,000) Serum creatinine 3.3 mg/dL (N=0.3–0.7)

Which of the following infectious agents is the most likely cause of these findings?

- (A) *Campylobacter jejuni*
- (B) *Escherichia coli*
- (C) Rotavirus
- (D) *Salmonella enterica* serovar enteritidis
- (E) *Yersinia pestis*

**Correct Answer:**

- (B) *Escherichia coli*

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The patient's clinical presentation is a classic case of Hemolytic Uremic Syndrome (HUS), which typically follows an infection with Shiga toxin-producing Escherichia coli (STEC), most commonly the O<sub>157</sub>:H<sub>7</sub> serotype. The progression began with bloody diarrhea (hemorrhagic colitis), followed approximately 5 days later by the classic triad of HUS: 1) Microangiopathic hemolytic anemia (indicated by a low hemoglobin of 8.5 g/dL and clinical pallor); 2) Thrombocytopenia (platelet count of 45,000/mm<sup>3</sup>); and 3) Acute kidney injury (serum creatinine elevated to 3.3 mg/dL and decreased urine output). The patient's elevated blood pressure (135/88 mm Hg) is a common secondary finding due to renal dysfunction and volume overload. While Campylobacter and Salmonella can cause bloody diarrhea, they are not the primary causes of HUS. Rotavirus typically causes watery, non-bloody diarrhea in children and does not lead to HUS. Yersinia pestis is the causative agent of plague and does not present with this gastrointestinal-renal syndrome.

## Question 71.1

A 78-year-old woman is admitted to the hospital because of a 1-week history of jaundice. CT scan of the abdomen shows a mass suggestive of pancreatic cancer. Three hours later, the on-call physician enters the patient's room to discuss the prognosis and obtain consent for a biopsy scheduled for the next morning. On entering the room, the physician greets the patient and her husband. The physician then learns that the patient speaks only Mandarin. Her husband is fluent in Mandarin and English. The hospital interpreter is not available until tomorrow morning. The patient's husband appears anxious and insists that the physician speaks to him and allows him to serve as an interpreter for his wife. Which of the following is the most appropriate next step in management?

- (A) Allow the patient's husband to serve as an interpreter
- (B) Consult the hospital ethics committee
- (C) Explain to the husband that information cannot be provided until the hospital interpreter arrives in the morning
- (D) Use a telephone interpreter service

**Correct Answer:**

- (D) Use a telephone interpreter service

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The core issue in this scenario is ensuring effective, unbiased, and accurate communication to facilitate informed consent and discuss a serious prognosis (suspected pancreatic cancer). According to medical ethics and standard clinical practice, professional medical interpreters are required whenever a language barrier exists to ensure patient autonomy and safety. Using a family member (Option A) is inappropriate because they may lack medical vocabulary, may intentionally or unintentionally filter information due to emotional distress, and their presence may prevent the patient from speaking freely about her own concerns. While the hospital interpreter is unavailable until the morning, most modern medical facilities have access to 24/7 telephone interpreter services. This allows the physician to proceed with the discussion immediately and professionally. Option B is incorrect as an ethics committee is generally reserved for unresolved conflicts or complex moral dilemmas, not for standard communication barriers. Option C is incorrect because delaying the discussion of a serious diagnosis and the consent process for a scheduled procedure when a telephone service is available is unnecessary and can increase patient and family anxiety.

## Question 72.1

A 4-year-old boy develops fever 3 weeks after being admitted to the hospital for induction chemotherapy for treatment of acute lymphoblastic leukemia. Chemotherapy medications are L-asparaginase, dexamethasone, doxorubicin, and vincristine. His temperature is 38.2°C (100.8°F), pulse is 122/min, and respirations are 24/min. Physical examination shows pallor, alopecia, and ulcerations over the gums. A central venous catheter with entry site in the right upper chest is present but has no surrounding erythema. A blood culture grows gram-negative rods after 36 hours. Which of the following underlying mechanisms is the most likely cause of this patient's susceptibility to infection?

- (A) Deficiency of terminal complement
- (B) Hypogammaglobulinemia
- (C) Impaired T-lymphocyte function
- (D) Inhibition of tumor necrosis factor  $\alpha$  function
- (E) Neutropenia

**Correct Answer:**

(E) Neutropenia

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** The patient is a 4-year-old boy undergoing induction chemotherapy for acute lymphoblastic leukemia (ALL) with a regimen (L-asparaginase, dexamethasone, doxorubicin, and vincristine) known to be highly myelosuppressive. Three weeks into treatment, he presents with fever, pallor, and gum ulcerations. These findings are classic for chemotherapy-induced pancytopenia: pallor indicates anemia, and gum ulcerations (mucositis) often occur alongside severe neutropenia. Neutrophils are the primary defense against bacterial pathogens. When the absolute neutrophil count (ANC) drops significantly (typically  $<500$  cells/mm<sup>3</sup>), patients become highly susceptible to endogenous flora and opportunistic pathogens. Gram-negative rods (such as *Pseudomonas aeruginosa*, *E. coli*, and *Klebsiella*) are common and life-threatening causes of bacteremia in neutropenic patients. While chemotherapy and steroids can affect T-cell function (C) and immunoglobulin levels (B), the acute presentation of fever and gram-negative bacteremia during the nadir of chemotherapy is most directly attributed to neutropenia. Terminal complement deficiency (A) predisposes specifically to *Neisseria* infections, and TNF-alpha inhibition (D) is associated with the reactivation of latent tuberculosis or fungal infections, neither of which fits this clinical picture.

### Question 73.1

A 65-year-old woman comes to the office for a follow-up examination 1 year after she underwent operative resection of the right colon and chemotherapy for stage III colon cancer. She reports fatigue. Physical examination shows no abnormalities. A staging CT scan of the chest and abdomen shows five new 2- to 3-cm masses in the liver and both lungs. This patient's cancer most likely spread to the lungs via which of the following structures?

- (A) Inferior mesenteric vein
- (B) Inferior vena cava
- (C) Left colic vein
- (D) Middle colic artery
- (E) Pulmonary vein
- (F) Superior mesenteric artery
- (G) Superior vena cava

**Correct Answer:**

- (B) Inferior vena cava

**Neural Consult Response and Explanation:**



**Answer:** B

**Explanation:** The patient has metastatic colon cancer that has spread to both the liver and the lungs. To understand the route of spread, one must trace the venous drainage from the primary site. The right colon is drained by the superior mesenteric vein, which joins the splenic vein to form the portal vein. The portal vein carries blood (and potentially malignant cells) directly to the liver, which is the most common site of metastasis for colorectal cancer. Once cancer cells have established themselves in the liver or passed through the hepatic sinusoids, they enter the hepatic venous system. The hepatic veins drain directly into the inferior vena cava (IVC). The IVC then carries this blood to the right atrium of the heart, which pumps it into the right ventricle and then into the pulmonary arteries to the lungs. Therefore, the IVC is the critical conduit for cancer cells traveling from the abdominal viscera and liver to the pulmonary circulation. Options A and C involve drainage of the distal colon; D and F are arteries (carrying blood away from the heart); E carries blood from the lungs to the heart; and G drains the upper body.

### Question 74.1

A 6-year-old boy with acute lymphoblastic leukemia is brought to the office for a follow-up examination. He is receiving high-dose methotrexate therapy. A drug is added to the patient's medication regimen to decrease the toxicity of this therapy to normal cells. The beneficial effect of this new drug on normal cells is most likely achieved by bypassing the cellular requirement for which of the following enzymes?

- (A) Dihydrofolate reductase
- (B) Methionine synthase
- (C) Pyruvate decarboxylase
- (D) Thiamine pyrophosphate
- (E) Thymidylate synthase

**Correct Answer:**

- (A) Dihydrofolate reductase

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient is receiving high-dose methotrexate (MTX), a chemotherapeutic agent that acts as a folic acid analog. MTX competitively inhibits the enzyme dihydrofolate reductase (DHFR), which is responsible for converting dihydrofolate (DHF) into tetrahydrofolate (THF). THF is a critical cofactor required for the synthesis of purines and thymidylate (via thymidylate synthase), which are essential for DNA replication. To mitigate the systemic toxicity of high-dose MTX, 'leucovorin rescue' (folinic acid) is administered. Leucovorin is a reduced form of folic acid (5-formyltetrahydrofolate) that does not require reduction by DHFR to be converted into the active THF derivatives needed for DNA synthesis. Therefore, it provides a source of reduced folates that bypasses the blocked DHFR enzyme, allowing normal cells to continue DNA synthesis and survive despite the presence of MTX. (B) Methionine synthase requires methyl-THF but is not the primary target bypassed by leucovorin. (C) Pyruvate decarboxylase is involved in carbohydrate metabolism and is unrelated to folate. (D) Thiamine pyrophosphate is a cofactor for several enzymes (like pyruvate dehydrogenase) but is not involved in the MTX pathway. (E) Thymidylate synthase is the enzyme that MTX indirectly inhibits by depleting its substrate (5,10-methylene THF), but leucovorin provides the necessary folate to allow this enzyme to function; it does not bypass the enzyme itself.

## Question 75.1

A 4082-g (9-lb) male newborn is delivered in the hospital at 40 weeks' gestation to a 28-year-old primigravid woman. Pregnancy and delivery were uncomplicated. Apgar scores were 8 and 9 at 1 and 5 minutes, respectively. Examination of the newborn's tongue shows a small blind pit in the midline located near the intersection of the anterior two-thirds and the posterior one-third.

Ultrasonography of the neck shows a mass attached to the hyoid bone. Cells in the mass produce a hormone that binds to which of the following?

- (A) G protein-linked receptors
- (B) Ligand-gated ion channels
- (C) Nuclear receptors
- (D) Receptor tyrosine kinases
- (E)  $\sigma$  Receptors

**Correct Answer:**

(C) Nuclear receptors

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The clinical presentation describes a thyroglossal duct cyst, which is the most common congenital neck mass. The 'small blind pit' at the junction of the anterior two-thirds and posterior one-third of the tongue refers to the foramen cecum, the embryological site where the thyroid gland begins its descent. A mass attached to the hyoid bone in the midline is characteristic of a thyroglossal duct remnant. These remnants often contain functional ectopic thyroid tissue. The cells in this mass produce thyroid hormones ( $T_3$  and  $T_4$ ). Thyroid hormones are lipophilic and act by diffusing across the plasma membrane and the nuclear envelope to bind to nuclear receptors. These receptors function as ligand-activated transcription factors that bind to thyroid hormone response elements (TREs) on DNA to regulate gene expression. Option A (G protein-linked receptors) is incorrect as these are used by peptide hormones (like TSH). Option B (Ligand-gated ion channels) is used by neurotransmitters. Option D (Receptor tyrosine kinases) is used by insulin and various growth factors. Option E ( $\sigma$  Receptors) is not the primary mechanism for thyroid hormone signaling.

## Question 76.1

An investigator is studying how mice respond to filarial parasitic infections. Mice deficient in a specific protein found in eosinophils (Group X) are compared with wild-type mice (Group Y). Biopsies of lymph nodes from Group X mice show more adult worms than lymph nodes from Group Y mice. Group X mice most likely lack which of the following?

- (A) Cathelicidin-related antimicrobial peptide
- (B) Lysozyme
- (C) Major basic protein
- (D) Myeloperoxidase
- (E)  $\alpha$ -Defensin

**Correct Answer:**

- (C) Major basic protein

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The question describes a deficiency in a protein specific to eosinophils that results in an impaired immune response to filarial parasitic (helminthic) infections. Eosinophils are the primary leukocytes involved in the defense against helminths. Their large secondary granules contain several highly cationic proteins, the most significant of which is Major Basic Protein (MBP). MBP functions by sticking to and disrupting the tegument (outer surface) of parasites, leading to their destruction. A deficiency in MBP (Group X) would directly result in a decreased ability to kill adult worms, explaining the higher worm burden compared to wild-type mice (Group Y). Other options are incorrect because: (A) Cathelicidins and (E) alpha-defensins are antimicrobial peptides primarily found in neutrophils and epithelial cells, targeting bacteria and fungi. (B) Lysozyme is an enzyme that degrades bacterial peptidoglycan and is found in neutrophils, macrophages, and secretions. (D) Myeloperoxidase is the hallmark enzyme of neutrophil azurophilic granules used to produce hypochlorous acid; while eosinophils have a related eosinophil peroxidase, myeloperoxidase itself is specific to the myeloid lineage leading to neutrophils and monocytes.

## Question 78.1

A 50-year-old man comes to the office because of a 2-month history of increasing daytime somnolence. He has obstructive sleep apnea for which he has only intermittently used a continuous positive airway pressure device. He is 170 cm (5 ft 7 in) tall and weighs 181 kg (400 lb); BMI is 63 kg/m<sup>2</sup>. His temperature is 37°C (98.6°F), pulse is 100/min, respirations are 12/min, and blood pressure is 135/80 mm Hg. Physical examination shows a gray-blue tinge to the lips, earlobes, and nail beds. Cardiac examination shows no other abnormalities. Arterial blood gas analysis on room air shows a pH of 7.31, PCO<sub>2</sub> of 70 mm Hg, and PO<sub>2</sub> of 50 mm Hg. Which of the following additional findings would be most likely in this patient?

- (A) Decreased serum bicarbonate concentration
- (B) Increased hemoglobin concentration
- (C) Increased total lung capacity
- (D) Left ventricular hypertrophy

**Correct Answer:**

- (B) Increased hemoglobin concentration

**Neural Consult Response and Explanation:**



**Answer:** B

**Explanation:** The patient presents with Obesity Hypoventilation Syndrome (OHS), also known as Pickwickian syndrome, characterized by a BMI > 30 kg/m<sup>2</sup>, daytime hypercapnia (PaCO<sub>2</sub> > 45 mmHg), and hypoxemia. This patient's ABG shows significant chronic respiratory acidosis (pH 7.31, PCO<sub>2</sub> 70 mmHg) and severe hypoxemia (PO<sub>2</sub> 50 mmHg). Chronic hypoxemia triggers the kidneys to increase the production of erythropoietin, which stimulates the bone marrow to produce more red blood cells (secondary polycythemia) to increase the oxygen-carrying capacity of the blood. Therefore, an increased hemoglobin concentration is a classic compensatory finding. Option A is incorrect because chronic respiratory acidosis leads to a compensatory increase in serum bicarbonate (renal compensation), not a decrease. Option C is incorrect because obesity is a restrictive lung disease process; the excess adipose tissue on the chest wall and abdomen reduces chest wall compliance, leading to decreased lung volumes, including decreased total lung capacity (TLC) and functional residual capacity (FRC). Option D is incorrect because the primary cardiac consequence of OHS and chronic hypoxemia is pulmonary vasoconstriction leading to pulmonary hypertension and right ventricular hypertrophy (cor pulmonale), rather than left ventricular hypertrophy.

## Question 79.1

An obese 35-year-old man comes to the office for a follow-up examination. He has chronic kidney disease and was told to keep a record of his meals until this follow-up visit. His daily diet consists of chocolate milk and a peanut butter sandwich for breakfast; pizza and cola for lunch; a chocolate bar as a snack; and a foot-long deli meat sandwich for dinner. He is 165 cm (5 ft 5 in) tall and weighs 113 kg (250 lb); BMI is 42 kg/m<sup>2</sup>. His pulse is 100/min, respirations are 23/min, and blood pressure is 155/100 mm Hg. Physical examination shows diaphoresis. Serum studies show a creatinine concentration of 4.1 mg/dL and phosphorus concentration of 6 mg/dL. Which of the following patterns is most likely in this patient?

- (A) Downregulated parathyroid hormone synthesis, increased serum calcium, increased Serum 1,25-Dihydroxycholecalciferol
- (B) Downregulated parathyroid hormone synthesis, increased serum calcium, decreased Serum 1,25-Dihydroxycholecalciferol
- (C) Downregulated parathyroid hormone synthesis, decreased serum calcium, decreased Serum 1,25-Dihydroxycholecalciferol
- (D) Upregulated parathyroid hormone synthesis, increased serum calcium, increased Serum 1,25-Dihydroxycholecalciferol
- (E) Upregulated parathyroid hormone synthesis, increased serum calcium, decreased Serum 1,25-Dihydroxycholecalciferol
- (F) Upregulated parathyroid hormone synthesis, decreased serum calcium, decreased Serum 1,25-Dihydroxycholecalciferol

**Correct Answer:**

(F) Upregulated parathyroid hormone synthesis, decreased serum calcium, decreased Serum 1,25-Dihydroxycholecalciferol



## Neural Consult Response and Explanation:

**Answer:** F

**Explanation:** The patient presents with advanced chronic kidney disease (CKD), indicated by a creatinine of 4.1 mg/dL and hyperphosphatemia (phosphorus 6 mg/dL). This clinical picture leads to Secondary Hyperparathyroidism through several mechanisms. First, the damaged kidneys have a reduced capacity to convert 25-hydroxyvitamin D into its active form, 1,25-dihydroxycholecalciferol (calcitriol), due to the loss of 1-alpha-hydroxylase activity and the inhibitory effects of Fibroblast Growth Factor 23 (FGF-23), which rises in response to phosphate retention. Second, the decrease in active vitamin D leads to reduced intestinal calcium absorption. Third, the elevated serum phosphorus can directly complex with calcium, further lowering ionized calcium levels. The parathyroid glands respond to the low serum calcium, low active vitamin D, and high phosphorus by upregulating the synthesis and secretion of Parathyroid Hormone (PTH) to compensate. Therefore, the expected pattern is upregulated PTH, decreased serum calcium, and decreased 1,25-dihydroxycholecalciferol.

## Question 81.1

A 60-year-old woman is nearing the completion of a half marathon. Because she experiences esophageal regurgitation, she does not drink any liquid during the race. This woman's physical state at the end of the race will most likely activate which of the following renal segments at this time?

- (A) Arginine vasoreceptor 2 in the proximal tubular cells
- (B)  $K^+-H^+$  exchange in the distal tubule
- (C) Proximal tubule carbonic anhydrase
- (D) Urea reabsorption in the medullary collecting ducts
- (E) Water reabsorption in the ascending loop of Henle

**Correct Answer:**

- (D) Urea reabsorption in the medullary collecting ducts

## Neural Consult Response and Explanation:



**Answer:** D

**Explanation:** The patient is in a state of significant dehydration due to prolonged physical exertion (half marathon) without fluid intake. This leads to increased plasma osmolality, which stimulates the release of Antidiuretic Hormone (ADH/Vasopressin) from the posterior pituitary. ADH acts on the  $V_2$  receptors of the collecting ducts. While its most famous effect is the insertion of Aquaporin-2 channels for water reabsorption, ADH also increases the expression and activity of urea transporters (UT-A<sub>1</sub> and UT-A<sub>3</sub>) in the inner medullary collecting ducts. This increased urea reabsorption is vital for maintaining the hyperosmotic medullary gradient, which provides the osmotic drive for water conservation. Option A is incorrect because  $V_2$  receptors are located in the collecting ducts, not the proximal tubule. Option B refers to acid-base regulation primarily in intercalated cells, which is not the primary response to dehydration. Option C refers to bicarbonate reabsorption in the proximal tubule. Option E is physiologically impossible as the ascending loop of Henle is impermeable to water.

## Question 82.1

An investigator is studying heart development in an experimental animal model. The animal model is genetically modified so that no cardiac neural crest cells develop. This animal model is most likely to have which of the following cardiac abnormalities?

- (A) Atrial septal defect
- (B) Coarctation of the aorta
- (C) Mitral stenosis
- (D) Persistent truncus arteriosus
- (E) Transposition of the great arteries

**Correct Answer:**

- (D) Persistent truncus arteriosus

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** Cardiac neural crest cells play a critical role in the development of the heart, specifically in the septation of the outflow tract. During embryogenesis, these cells migrate from the neural folds to the pharyngeal arches and then into the truncus arteriosus. Once there, they contribute to the formation of the aorticopulmonary septum, which is responsible for dividing the common truncus arteriosus into the separate ascending aorta and pulmonary trunk. If cardiac neural crest cells fail to develop or migrate, this septation process cannot occur, resulting in a single large vessel arising from the heart that overrides both ventricles, a condition known as persistent truncus arteriosus. Other conotruncal defects, such as Tetralogy of Fallot or transposition of the great arteries, are also associated with neural crest abnormalities, but persistent truncus arteriosus is the most direct consequence of a total failure of septation. Atrial septal defects (A) involve the septum primum and secundum, which are not derived from neural crest cells. Coarctation of the aorta (B) is typically related to abnormal ductal tissue or hemodynamics. Mitral stenosis (C) involves the atrioventricular valves, which develop from endocardial cushions. Transposition of the great arteries (E) results from a failure of the aorticopulmonary septum to spiral, rather than a complete failure of the septum to form.

### Question 83.1

A 78-year-old woman undergoes an outpatient laparoscopic cholecystectomy. During the procedure, ligation of the cystic artery is planned. It is most appropriate to ligate this artery at its junction with which of the following arteries?

- (A) Gastroduodenal
- (B) Left gastric
- (C) Left hepatic
- (D) Right gastric
- (E) Right hepatic

**Correct Answer:**

- (E) Right hepatic

**Neural Consult Response and Explanation:**



**Answer:** E

**Explanation:** In standard human anatomy, the cystic artery most commonly arises as a branch of the right hepatic artery. During a laparoscopic cholecystectomy, the surgeon identifies the cystic artery within the hepatocystic triangle (Calot's triangle), which is bounded by the cystic duct, the common hepatic duct, and the inferior border of the liver. The right hepatic artery typically passes behind the common hepatic duct before giving off the cystic artery. Ligation is performed close to the gallbladder to avoid inadvertent injury to the right hepatic artery itself, but the anatomical junction point is with the right hepatic artery. The other options are incorrect because: (A) The gastroduodenal artery typically arises from the common hepatic artery and supplies the stomach and duodenum; (B) The left gastric artery arises from the celiac trunk; (C) The left hepatic artery supplies the left lobe of the liver and does not typically give rise to the cystic artery; (D) The right gastric artery typically arises from the proper hepatic artery to supply the lesser curvature of the stomach.

## Question 84.1

A 32-year-old man comes to the office because of a 2-week history of fever and throat pain. He is 173 cm (5 ft 8 in) tall and weighs 63 kg (140 lb); BMI is 21 kg/m<sup>2</sup>. His pulse is 110/min, respirations are 16/min, and blood pressure is 98/68 mm Hg. Physical examination shows scattered 2- to 4-cm lymph nodes in the neck, axillae, and inguinal regions. There is a bilateral tonsillar exudate but no ulcerations. Results of laboratory studies are shown: Hemoglobin 9.6 g/dL

Hematocrit 29%

Leukocyte count 1500/mm<sup>3</sup>

Platelet count 60,000/mm<sup>3</sup>

A heterophile antibody test result is negative. Which of the following is the most likely diagnosis?

- (A) Epstein-Barr virus infection
- (B) Gonococcal pharyngitis
- (C) HIV infection
- (D) Lymphogranuloma venereum infection
- (E) Streptococcal pharyngitis

**Correct Answer:**

(C) HIV infection

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The patient presents with a mononucleosis-like syndrome characterized by fever, pharyngitis with tonsillar exudates, and generalized lymphadenopathy (neck, axillae, and inguinal regions). The most critical diagnostic clues are the laboratory findings showing pancytopenia (anemia with Hb 9.6 g/dL, leukopenia with WBC 1,500/mm<sup>3</sup>, and thrombocytopenia with platelets 60,000/mm<sup>3</sup>). Acute HIV infection (Acute Retroviral Syndrome) frequently presents with these clinical symptoms and is a well-recognized cause of bone marrow suppression leading to pancytopenia. While Epstein-Barr virus (EBV) can cause similar clinical symptoms, it typically presents with an absolute lymphocytosis and atypical lymphocytes rather than profound leukopenia; additionally, the heterophile antibody test is negative, which is less common two weeks into an EBV infection in an adult. Streptococcal and gonococcal pharyngitis (Options B and E) cause localized rather than generalized lymphadenopathy and do not cause pancytopenia. Lymphogranuloma venereum (Option D) typically presents with localized inguinal lymphadenopathy (buboes) and proctitis rather than a systemic mononucleosis-like illness with bone marrow suppression.

## Question 86.1

A 51-year-old man with a 10-year history of gastroesophageal reflux and suspected Barrett esophagus comes to the office because his omeprazole dose "doesn't work around the Christmas holidays." He states that he prides himself on having a large appetite and "holding his liquor" during the holidays. He currently takes the maximum dose of omeprazole. Which of the following is the most appropriate initial action by the physician?

- (A) Ask the patient how much he is eating and drinking during the holidays
- (B) Explain the hazards of untreated reflux in the presence of Barrett esophagus
- (C) Order an upper endoscopy
- (D) Refer the patient to a gastroenterologist
- (E) Switch the omeprazole to pantoprazole

**Correct Answer:**

- (A) Ask the patient how much he is eating and drinking during the holidays

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient provides a direct clinical clue by mentioning his 'large appetite' and ability to 'hold his liquor' specifically during the holidays, which coincides with his symptom exacerbation. In the management of Gastroesophageal Reflux Disease (GERD), lifestyle and dietary modifications are foundational. Alcohol and large, high-fat meals are potent triggers that can overcome even maximal proton pump inhibitor (PPI) therapy by decreasing lower esophageal sphincter (LES) pressure and increasing gastric distention. Before escalating to invasive diagnostic procedures like an upper endoscopy (C), referring to a specialist (D), or switching to a different medication in the same class (E), the physician must first quantify and address the modifiable triggers. This aligns with the 'Ask' component of the 5 A's model of behavioral change and represents the most cost-effective and patient-centered initial step. While Barrett esophagus requires surveillance, the immediate concern is the seasonal breakthrough of symptoms clearly linked to behavioral factors.

## Question 87.1

A 60-year-old man comes to the office because of weakness, tingling of his hands and feet, irritability, and forgetfulness for 4 months. Physical examination shows pallor, weakness, and spasticity. Deep tendon reflexes are increased. Sensation to vibration is absent in the lower extremities. Laboratory studies show megaloblastic anemia, serum antiparietal cell antibodies, and increased serum concentrations of methylmalonic acid and total homocyst(e)ine. The synthesis of which of the following amino acids is most likely impaired in this patient?

- (A) Cysteine
- (B) Glutamine
- (C) Methionine
- (D) Phenylalanine
- (E) Tyrosine

**Correct Answer:**

(C) Methionine

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The patient presents with classic signs of Vitamin B<sub>12</sub> (cobalamin) deficiency, including megaloblastic anemia and subacute combined degeneration of the spinal cord (characterized by spasticity, increased reflexes, and loss of vibratory sensation). The laboratory findings of antiparietal cell antibodies suggest pernicious anemia as the underlying cause. Biochemically, Vitamin B<sub>12</sub> is a necessary cofactor for two enzymes: methylmalonyl-CoA mutase and methionine synthase. Methionine synthase catalyzes the transfer of a methyl group from N<sub>5</sub>-methyltetrahydrofolate to homocysteine to form methionine. In B<sub>12</sub> deficiency, this reaction is impaired, leading to the accumulation of homocysteine and a deficiency in methionine synthesis. While cysteine synthesis also involves homocysteine (via the cystathionine beta-synthase pathway), it is not the primary amino acid whose synthesis is directly blocked by the absence of B<sub>12</sub>; rather, the conversion of homocysteine back to methionine is the specific step requiring cobalamin. Phenylalanine and tyrosine synthesis are unrelated to the B<sub>12</sub>-dependent pathways.

## Question 90.1

A 12-year-old girl is brought to the office because of a 2-day history of chest pain. She also had a 3-day history of fever that has since resolved. When she lies down, the pain worsens and she has shortness of breath. Her temperature is 37°C (98.6°F). A friction rub is heard. Which of the following is the most likely causal infectious agent?

- (A) Coxsackievirus
- (B) Mumps virus
- (C) Staphylococcus aureus
- (D) Staphylococcus epidermidis
- (E) Viridans streptococcus

**Correct Answer:**

- (A) Coxsackievirus

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The clinical presentation describes a classic case of acute pericarditis in a pediatric patient. The key findings include pleuritic chest pain that worsens when supine (lying down), a recent history of a viral prodrome (fever), and the pathognomonic physical exam finding of a pericardial friction rub. In children and adolescents in developed countries, the most common etiology of acute pericarditis is viral infection. Among viral causes, Enteroviruses—specifically Coxsackievirus B—are the most frequently identified agents. Coxsackievirus has a high tropism for the myocardium and pericardium. Option B (Mumps) is a rare cause due to widespread vaccination. Options C, D, and E represent bacterial causes. Staphylococcus aureus (C) can cause purulent pericarditis, but this usually presents with high fever, severe systemic illness (sepsis), and often follows surgery or hematogenous spread, which does not fit this patient's relatively mild course. Staphylococcus epidermidis (D) and Viridans streptococcus (E) are more commonly associated with subacute bacterial endocarditis rather than isolated pericarditis.

## Question 91.1

A 32-year-old man comes to the office because of a 1-day history of cough productive of small amounts of blood and a 2-day history of shortness of breath and swelling of his ankles. He also has a 2-week history of progressive fatigue and episodes of dark urine. He has no history of major medical illness and takes no medications. His temperature is 37°C (98.6°F), pulse is 90/min, respirations are 18/min, and blood pressure is 175/110 mm Hg. Pulse oximetry on room air shows an oxygen saturation of 91%. Diffuse inspiratory crackles are heard over all lung bases. There is 2+ pitting edema of both ankles.

Results of laboratory studies are shown:

Hemoglobin 8.9 g/dL

Hematocrit 27%

Serum Urea nitrogen 55 mg/dL

Creatinine 2.9 mg/dL

Urine RBC 20–40/hpf

Urinalysis also shows some dysmorphic RBCs and rare RBC casts. Examination of a kidney biopsy specimen shows crescentic glomerulonephritis and linear deposition of IgG along the glomerular capillaries. This patient most likely has antibodies directed against which of the following antigens?

- (A) Collagen
- (B) Double-stranded DNA
- (C) Nucleolar protein
- (D) Phospholipid
- (E) Proteins in neutrophil cytoplasm

**Correct Answer:**

(A) Collagen



## Neural Consult Response and Explanation:

**Answer:** A

**Explanation:** The patient presents with a classic pulmonary-renal syndrome, characterized by hemoptysis (alveolar hemorrhage) and rapidly progressive glomerulonephritis (hematuria, RBC casts, hypertension, and acute kidney injury). The key diagnostic finding is the kidney biopsy showing crescentic glomerulonephritis with linear deposition of IgG along the glomerular capillaries. This linear pattern on immunofluorescence is pathognomonic for Anti-Glomerular Basement Membrane (Anti-GBM) disease, also known as Goodpasture syndrome when it involves both the lungs and kidneys. The autoantibodies in this condition are specifically directed against the non-collagenous (NC<sub>1</sub>) domain of the alpha-3 chain of type IV collagen, which is found in the basement membranes of the glomeruli and pulmonary alveoli. Option B (anti-dsDNA) is associated with Systemic Lupus Erythematosus, which typically shows a granular 'lumpy-bumpy' pattern of immune complex deposition. Option E (ANCA) is associated with vasculitides like Granulomatosis with Polyangiitis, which characteristically shows a 'pauci-immune' pattern (minimal to no staining on immunofluorescence) rather than linear IgG deposition.

## Question 92.1

A 58-year-old man with chronic obstructive pulmonary disease comes to the clinic with his wife for a follow-up examination. He has smoked one pack of cigarettes daily for 35 years. He has tried to quit smoking twice but was unsuccessful both times. At today's visit, when the physician asks the patient about smoking cessation, he says he is not ready to do so. The patient's wife states her husband's smoking makes her cough and gives her chest tightness. Which of the following is the most appropriate physician statement?

- (A) "Are there any reasons why you might want to quit smoking?"
- (B) "Are you aware that your lung condition is chronic at this point?"
- (C) "I'm sure you don't want your wife to suffer as a result of your smoking."
- (D) "The majority of your health issues would improve if you quit smoking."
- (E) "Why haven't you been able to stay off cigarettes?"

### Correct Answer:

- (A) "Are there any reasons why you might want to quit smoking?"

## Neural Consult Response and Explanation:



**Answer:** A

**Explanation:** The patient is in the precontemplation stage of change, as evidenced by his statement that he is 'not ready' to quit smoking. According to the Transtheoretical Model of Change and the '5 A's' of smoking cessation (Ask, Advise, Assess, Assist, Arrange), the physician's goal at this stage is to move the patient toward contemplation by exploring his personal motivations and barriers without being confrontational. Option (A) is an open-ended question that encourages the patient to identify his own intrinsic motivators (autonomy), which is a core principle of Motivational Interviewing. Option (B) is a closed-ended question that may feel condescending. Option (C) uses guilt and is presumptive, which can damage the physician-patient relationship. Option (D) is a directive 'Advise' statement; while medically true, it is less effective than eliciting the patient's own perspective when he has already expressed resistance. Option (E) is a 'why' question that can sound accusatory and may lead to defensiveness, focusing on past failures rather than future possibilities.

### Question 93.1

A 26-year-old man comes to the office because of a 1-week history of increased urinary frequency accompanied by excessive thirst. He says he has been urinating hourly. Physical examination shows no abnormalities. Serum chemistry studies are within the reference ranges. Urine osmolality is 50 mOsmol/kg H<sub>2</sub>O. After administration of ADH (vasopressin), his urine osmolality is within the reference range. The most likely cause of this patient's symptoms is dysfunction of which of the following structures?

- (A) Anterior pituitary gland
- (B) Bowman capsule
- (C) Glomerulus
- (D) Hypophysial portal system
- (E) Loop of Henle
- (F) Supraoptic nucleus

**Correct Answer:**

- (F) Supraoptic nucleus

**Neural Consult Response and Explanation:**



**Answer:** F

**Explanation:** The patient presents with symptoms of polyuria and polydipsia, and a very low urine osmolality (50 mOsmol/kg H<sub>2</sub>O), which confirms diabetes insipidus (DI). The key diagnostic finding is that after the administration of ADH (vasopressin), the urine osmolality increases to the reference range. This response to exogenous ADH indicates that the kidneys are capable of concentrating urine but lack the endogenous hormone, confirming a diagnosis of Central Diabetes Insipidus (CDI). Antidiuretic hormone (ADH), also known as vasopressin, is synthesized in the cell bodies of magnocellular neurons located in the hypothalamus, specifically the supraoptic and paraventricular nuclei. These hormones are then transported down axons to the posterior pituitary for storage and release. Dysfunction of the supraoptic nucleus leads to a deficiency in ADH production, resulting in CDI. Other options are incorrect because: (A) the anterior pituitary does not produce ADH; (B, C, E) these are renal structures, and dysfunction there would cause Nephrogenic DI, where the urine would not concentrate after ADH administration; (D) the hypophysial portal system carries regulatory hormones to the anterior pituitary, whereas ADH travels via axonal transport to the posterior pituitary.

## Question 94.1

A 19-year-old man who is in the US Army is brought to the emergency department 45 minutes after he sustained a knife wound to the right side of his chest during an altercation. He has no history of major medical illness and takes no medications. His temperature is 36.9°C (98.4°F), pulse is 110/min, respirations are 24/min, and blood pressure is 114/76 mm Hg. Pulse oximetry on room air shows an oxygen saturation of 94%. On physical examination, the trachea appears to be shifted to the left. Pulmonary examination of the right chest is most likely to show which of the following findings?

- (A) Decreased Fremitus, dull Percussion, decreased breath sounds
- (B) Decreased Fremitus, hyperresonant Percussion, decreased breath sounds
- (C) Decreased Fremitus, hyperresonant Percussion, dull breath sounds
- (D) Increased Fremitus, dull Percussion, bronchial breath sounds
- (E) Increased Fremitus, dull Percussion, decreased breath sounds

**Correct Answer:**

(B) Decreased Fremitus, hyperresonant Percussion, decreased breath sounds

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The clinical presentation is highly suggestive of a right-sided tension pneumothorax following a penetrating chest injury. Key findings include tachycardia, tachypnea, and a tracheal shift to the left (away from the side of the injury). In a pneumothorax, air accumulates in the pleural space, separating the lung from the chest wall. This layer of air acts as an insulator, leading to decreased tactile fremitus (vibrations from the lung are not transmitted effectively to the chest wall) and decreased or absent breath sounds. Because the pleural space is filled with air under pressure rather than solid tissue or fluid, percussion of the chest wall yields a hyperresonant (tympanic) sound. Option A describes a pleural effusion or hemothorax (dull percussion). Options D and E describe consolidation (increased fremitus). Option C is incorrect as 'dull breath sounds' is not standard terminology and hyperresonance is paired with decreased sounds in this pathology.

## Question 95.1

A 45-year-old man comes to the office for a follow-up examination 1 month after routine urinalysis showed an increased protein concentration. He has a 15-year history of type 2 diabetes mellitus and a 10-year history of hypertension. Current medications include hydrochlorothiazide, insulin, and metformin. His blood pressure is 150/80 mm Hg. Physical examination shows no other abnormalities. Daily lisinopril therapy is started. Which of the following sets of changes in glomerular hemodynamics is most likely to occur in this patient as a result of this pharmacotherapy?

- (A) increased renal blood flow, increased ultrafiltration pressure, decreased glomerular filtration rate
- (B) increased renal blood flow, decreased ultrafiltration pressure, increased glomerular filtration rate
- (C) increased renal blood flow, decreased ultrafiltration pressure, decreased glomerular filtration rate
- (D) decreased renal blood flow, increased ultrafiltration pressure, decreased glomerular filtration rate
- (E) decreased renal blood flow, decreased ultrafiltration pressure, increased glomerular filtration rate
- (F) decreased renal blood flow, decreased ultrafiltration pressure, decreased glomerular filtration rate

**Correct Answer:**

(C) ↑ renal blood flow, ↓ ultrafiltration pressure, ↓ glomerular filtration rate

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The patient has diabetic nephropathy, characterized by hyperfiltration and increased intraglomerular pressure, largely driven by the effects of Angiotensin II. Angiotensin II preferentially constricts the efferent arteriole, which increases the glomerular capillary hydrostatic pressure (ultrafiltration pressure) and maintains or increases the Glomerular Filtration Rate (GFR) while potentially reducing Renal Blood Flow (RBF) due to increased resistance. Lisinopril is an ACE inhibitor that blocks the conversion of Angiotensin I to Angiotensin II. The reduction in Angiotensin II levels leads to a preferential dilation of the efferent arteriole. This physiological change has three primary effects on glomerular hemodynamics: 1) It reduces the resistance to blood flow through the kidney, thereby increasing Renal Blood Flow (RBF). 2) It reduces the 'back-pressure' within the glomerular capillaries, leading to a decrease in the glomerular capillary hydrostatic pressure (ultrafiltration pressure). 3) Because the ultrafiltration pressure is the primary driving force for filtration, its decrease results in a decrease in the Glomerular Filtration Rate (GFR). This reduction in GFR and pressure is the mechanism by which ACE inhibitors provide long-term renoprotection in diabetic patients, as it reduces mechanical strain on the glomerular basement membrane and decreases proteinuria.

## Question 96.1

A 3438-g (7-lb 9-oz) female newborn is delivered in the hospital at term to a 24-year-old primigravid woman after an uncomplicated pregnancy. Apgar scores are 8 and 9 at 1 and 5 minutes, respectively. Examination of the newborn shows ambiguous genitalia. Results of a blood analysis show markedly increased serum concentrations of 17-hydroxyprogesterone. Genetic analysis shows a karyotype of 46,XX. Further testing of this newborn is most likely to show a deficiency of which of the following enzymes?

- (A) 11 $\beta$ -Hydroxylase
- (B) 21 $\alpha$ -Hydroxylase
- (C) 3 $\alpha$ -Hydroxysteroid dehydrogenase
- (D) 3 $\beta$ -Hydroxysteroid dehydrogenase
- (E) 5 $\alpha$ -Reductase
- (F) 17 $\alpha$ -Reductase

**Correct Answer:**

(B) 21 $\alpha$ -Hydroxylase

**Neural Consult Response and Explanation:**



**Answer:** B

**Explanation:** The clinical presentation of a 46,XX newborn with ambiguous genitalia and markedly elevated 17-hydroxyprogesterone (17-OHP) is classic for Congenital Adrenal Hyperplasia (CAH) due to 21-hydroxylase deficiency. In the steroidogenesis pathway, 21-hydroxylase is responsible for converting 17-hydroxyprogesterone into 11-deoxycortisol (the precursor to cortisol) and progesterone into 11-deoxycorticosterone (the precursor to aldosterone). A deficiency in this enzyme leads to a 'block' in the pathway, causing 17-OHP to accumulate and be shunted toward the production of adrenal androgens (androstenedione and testosterone). These excess androgens cause virilization of the female fetus in utero, resulting in ambiguous genitalia. 21-hydroxylase deficiency accounts for approximately 95% of CAH cases. (A) 11 $\beta$ -Hydroxylase deficiency also causes virilization and CAH, but it typically presents with elevated 11-deoxycortisol and deoxycorticosterone, often leading to hypertension. (D) 3 $\beta$ -Hydroxysteroid dehydrogenase deficiency would result in low levels of 17-OHP, as this enzyme is required to produce it. (E) 5 $\alpha$ -Reductase deficiency affects the conversion of testosterone to dihydrotestosterone and would present as ambiguous genitalia in a 46,XY male, not a 46,XX female. (F) 17 $\alpha$ -Hydroxylase deficiency would prevent the formation of 17-OHP and androgens, leading to a lack of pubertal development and hypertension, but not virilization of a female.

## Question 97.1

A 27-year-old woman comes to the emergency department because of a 1-hour history of severe shortness of breath. She has just returned from a cross-country flight. She has a history of borderline hypertension. Her temperature is 36.9°C (98.5°F), pulse is 113/min, respirations are 28/min, and blood pressure is 138/85 mm Hg. Physical examination shows that the right calf has an increased circumference compared with the left calf, and there is tenderness behind the right knee. Which of the following is the most likely underlying cause of this patient's condition?

- (A) Antithrombin III deficiency
- (B) Factor V Leiden mutation
- (C) Glanzmann thrombasthenia
- (D) Protein C deficiency
- (E) von Willebrand disease

**Correct Answer:**

(B) Factor V Leiden mutation

**Neural Consult Response and Explanation:**



**Answer:** B

**Explanation:** The patient presents with classic signs and symptoms of a pulmonary embolism (PE) secondary to a deep vein thrombosis (DVT). This is evidenced by the sudden onset of shortness of breath, tachycardia (113/min), tachypnea (28/min), and unilateral leg swelling/tenderness following a period of immobility (cross-country flight). In a young patient (27 years old) presenting with a venous thromboembolism (VTE), an underlying hereditary thrombophilia should be considered. Factor V Leiden mutation is the most common inherited cause of hypercoagulability in the Caucasian population, accounting for approximately 20-50% of cases of unexplained VTE. It involves a mutation in the Factor V gene that makes the protein resistant to inactivation by activated protein C. While Antithrombin III deficiency (A) and Protein C deficiency (D) also cause hypercoagulable states, they are significantly rarer than Factor V Leiden. Glanzmann thrombasthenia (C) and von Willebrand disease (E) are bleeding disorders characterized by platelet dysfunction or deficiency in clotting factors, respectively, and would not predispose a patient to thrombosis.

### Question 98.1

A 17-year-old boy is brought to the clinic for a follow-up examination. He has been evaluated for three episodes of full-body weakness at the ages of 13, 16, and 17 years. Each episode occurred when he lay down after playing in a football scrimmage. The weakness improved spontaneously during the next 6 hours; he was asymptomatic by the time he was evaluated by medical personnel. The patient attributes the episodes to eating "a lot of pasta and salty foods" prior to playing football. Results of a complete blood count and comprehensive metabolic profile following each episode have been within the reference ranges. He has no history of serious illness and takes no medications. Vital signs are within normal limits. Physical and neurologic examinations disclose no abnormalities. Which of the following serum concentrations is most likely to be abnormal if measured during one of this patient's episodes?

- (A) Calcium
- (B) Chloride
- (C) Magnesium
- (D) Potassium
- (E) Sodium

**Correct Answer:**

- (D) Potassium

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The patient's presentation is classic for Hypokalemic Periodic Paralysis (HypoPP), a channelopathy characterized by episodic muscle weakness. The triggers described—strenuous exercise followed by rest and a high-carbohydrate meal (pasta)—are the hallmark precipitants of this condition. High carbohydrate intake leads to insulin release, which stimulates the Na<sup>+</sup>/K<sup>+</sup>-ATPase pump, driving potassium into the intracellular compartment. Similarly, rest after exercise is associated with a shift of potassium into muscle cells. During these episodes, the total body potassium remains normal, but the serum concentration drops significantly (typically <3.5 mEq/L), leading to muscle membrane inexcitability and flaccid paralysis. Between episodes, serum potassium levels return to the reference range, which explains why his previous metabolic profiles (taken when asymptomatic) were normal. Other electrolytes like sodium, calcium, and magnesium are not typically the primary abnormality during these specific episodic events.

### Question 99.1

A 20-year-old woman is brought to the urgent care center because of a 2-month history of progressive weakness of her arms. She also has a 1-week history of moderate back pain and headache. Her only medication is ibuprofen as needed for pain. Muscle strength is 3/5 in the upper extremities. Sensation to pinprick is decreased over the upper extremities. MRI of the spine shows a central syrinx in the cervical spinal cord. It is most appropriate to obtain specific additional history regarding which of the following in this patient?

- (A) Diet
- (B) Family illness
- (C) Recent travel
- (D) Trauma
- (E) Unintended weight loss

**Correct Answer:**

- (D) Trauma

**Neural Consult Response and Explanation:**



**Answer: D**

**Explanation:** The patient presents with classic signs of syringomyelia, including progressive upper extremity weakness and a 'cape-like' distribution of sensory loss (decreased pinprick sensation), confirmed by an MRI showing a central syrinx in the cervical spinal cord. Syringomyelia is a condition where a fluid-filled cavity (syrinx) forms within the spinal cord. While many cases are associated with Chiari I malformations (which would explain the headache), another common and clinically significant cause is post-traumatic syringomyelia. This condition can develop months or even years after a spinal cord injury, often presenting with new or ascending neurological deficits. Inquiring about a history of trauma (Option D) is essential because it identifies a specific, known etiology for the development of a syrinx. Other options like diet (A), family history (B), and travel (C) are not standard risk factors for syrinx formation. While unintended weight loss (E) might suggest a tumor, post-traumatic causes are a more frequently tested and recognized historical factor in the context of progressive myelopathy following a stable period.

## Question 101.1

A 15-year-old girl is brought to the rehabilitation facility for physical therapy. Two months ago, she was involved in a motor vehicle collision in which she sustained a crush injury to the ulnar nerve at the right elbow. Neurologic examination shows severe weakness and atrophy of the intrinsic muscles of the right hand. When the patient is asked to grasp the therapist's fingers, right handgrip is noticeably weaker than left handgrip. Sensation to pinprick and fine touch is decreased at the palmar aspect of the ring and small fingers of the right hand. No other deficits are noted. Which of the following cell types is critical for recovery of neurologic function in this patient?

- (A) Astrocytes
- (B) Oligodendrocytes
- (C) Satellite cells
- (D) Schwann cells
- (E) Tanycytes

**Correct Answer:**

(D) Schwann cells

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The patient has sustained a crush injury to the ulnar nerve, which is a peripheral nerve. In the peripheral nervous system (PNS), Schwann cells are the primary glial cells responsible for both myelination and the response to injury. Following a peripheral nerve injury, the distal segment of the axon undergoes Wallerian degeneration. During this process, Schwann cells play a pivotal role by dedifferentiating, proliferating, and forming longitudinal columns known as bands of Büngner. These bands provide a structural and biochemical scaffold that guides regenerating axonal sprouts toward their target tissues. Once the axon reaches its destination, Schwann cells then remyelinate the new axon. Astrocytes (A) and Oligodendrocytes (B) are glial cells of the central nervous system (CNS); oligodendrocytes do not support regeneration effectively, and astrocytes often form a glial scar that inhibits it. Satellite cells (C) surround neuronal cell bodies in ganglia but do not guide axonal regrowth. Tanycytes (E) are specialized ependymal cells in the third ventricle of the brain and are not involved in peripheral nerve repair.

## Question 102.1

A 3-year-old boy is brought to the office because of a 2-day history of bulging of his left eye. He says his eye hurts. He has no history of major medical illness or recent trauma to the area, and he receives no medications. Vital signs are within normal limits. Physical examination shows exophthalmos of the left eye. MRI of the brain shows a 2-cm mass involving the ocular muscles of the left eye. A biopsy specimen of the mass shows malignant cells, some of which have striations. Which of the following is the most likely diagnosis?

- (A) Neuroblastoma
- (B) Pheochromocytoma
- (C) Retinoblastoma
- (D) Rhabdomyosarcoma
- (E) Thyroid cancer

**Correct Answer:**

- (D) Rhabdomyosarcoma

**Neural Consult Response and Explanation:**



**Answer: D**

**Explanation:** The clinical presentation of a 3-year-old child with rapid-onset exophthalmos (proptosis) and an orbital mass involving the ocular muscles is highly suggestive of rhabdomyosarcoma, which is the most common primary orbital malignancy in children. The definitive diagnostic clue provided is the biopsy finding of malignant cells with 'striations.' These striations represent the organized sarcomeres (actin and myosin filaments) characteristic of skeletal muscle differentiation. Cells exhibiting these features are known as rhabdomyoblasts. Among the choices: (A) Neuroblastoma typically presents with 'raccoon eyes' (periorbital ecchymosis) due to orbital metastases, but the primary tumor is usually in the adrenal gland or sympathetic chain, and histology shows small blue round cells and Homer Wright rosettes, not striations. (B) Pheochromocytoma is a catecholamine-secreting tumor of the adrenal medulla, rare in young children, and presents with hypertension. (C) Retinoblastoma is an intraocular tumor that presents with leukocoria (white pupillary reflex) and does not involve the ocular muscles or show skeletal muscle striations. (E) Thyroid cancer is rare in a 3-year-old and, while Graves' disease can cause exophthalmos, it is not a malignant mass involving the muscles with striations. Therefore, rhabdomyosarcoma is the only diagnosis that fits the age, location, and histology.

### Question 103.1

An 11-year-old girl is brought to the emergency department by her parents because of a 1-week history of breast enlargement. She has not had pain or nipple discharge. She has asthma treated with inhaled albuterol as needed. She does not smoke cigarettes, drink alcoholic beverages, or use illicit drugs. She is at the 50th percentile for height and weight. Vital signs are within normal limits. Examination of the breasts shows minimal enlargement under the areolae and mild enlargement of the diameter of the areolae without nipple discharge; no masses are palpated. There is scant pubic hair. Which of the following best describes the sexual maturity rating for this patient?

- (A) 1
- (B) 2
- (C) 3
- (D) 4
- (E) 5

**Correct Answer:**

- (B) 2

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The patient's physical examination findings correspond to Tanner Stage 2 of sexual maturity. In girls, Tanner Stage 2 for breast development (thelarche) is characterized by the 'breast bud' stage, where there is a small mound of breast tissue and papilla with an increase in the diameter of the areola. This matches the description of 'minimal enlargement under the areolae and mild enlargement of the diameter of the areolae.' For pubic hair (pubarche), Tanner Stage 2 is characterized by sparse, long, slightly pigmented hair, primarily along the labia, which matches the description of 'scant pubic hair.' Tanner Stage 1 would represent a prepubertal state (no tissue or hair), Stage 3 involves further enlargement of the breast and areola without separation of contours and darker/curlier hair, Stage 4 involves a secondary mound of the areola and papilla, and Stage 5 represents the adult contour and distribution. Therefore, Stage 2 is the most accurate rating for this patient.

## Question 104.1

A 5-year-old boy is brought to the emergency department by his mother because of an episode of bloody stool 3 hours ago. The mother says the stool was hard "like pebbles" and she noted bright red blood on the tissue when the patient cleaned himself. His previous bowel movement was 5 days ago. The patient has no abdominal or rectal pain now, but he did have abdominal pain during his bowel movement 5 days ago. He has no history of major medical illness and receives no medications. Vaccinations are up-to-date. The patient has no recent history of travel. He is at the 5th percentile for height and the 10th percentile for weight; BMI is at the 50th percentile. Vital signs are within normal limits. Abdominal examination shows hypoactive bowel sounds and a soft, slightly distended abdomen that is not tender to palpation. Rectal examination shows 1 cm of bright red rectal mucosa protruding from the right side of the anus; there is no rectal bleeding. The remainder of the examination shows no abnormalities. Which of the following is the most likely cause of this patient's physical findings?

- (A) Constipation
- (B) Cystic fibrosis
- (C) Hirschsprung disease
- (D) Hookworm infestation
- (E) Intussusception

**Correct Answer:**

- (A) Constipation

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient's clinical presentation is most consistent with functional constipation leading to a rectal prolapse. Key features include a history of infrequent bowel movements (none for 5 days), hard stools described as 'pebbles' (Bristol Type 1), and straining during defecation. The physical exam finding of '1 cm of bright red rectal mucosa protruding' is a classic description of a rectal prolapse, which in pediatric populations is most commonly caused by the increased intra-abdominal pressure associated with chronic straining during constipation. The bright red blood on the tissue is likely from an anal fissure or the friable prolapsed mucosa itself. While Cystic Fibrosis (B) is a known risk factor for rectal prolapse due to malabsorption and bulky stools, this patient has a normal BMI (50th percentile), making a primary diagnosis of functional constipation more likely. Hirschsprung disease (C) typically presents earlier in life with a failure to pass meconium and would more likely show a tight anal sphincter rather than prolapse. Hookworm infestation (D) usually presents with iron deficiency anemia and diarrhea rather than hard stools. Intussusception (E) presents with acute 'currant jelly' stools and severe intermittent pain, which does not match this patient's 5-day history of constipation and current lack of pain.

## Question 106.1

An 80-year-old woman is brought to the emergency department (ED) 30 minutes after she fell out of her wheelchair at home. This is the second visit to the ED for a fall during the past 3 months. She lives with her daughter and son-in-law, who say they "do the best we can." The patient has dementia, Alzheimer type, coronary artery disease, type 2 diabetes mellitus, and hypertension. Current medications are amlodipine, aspirin, atorvastatin, donepezil, long-acting insulin, and lisinopril. Five years ago, she underwent bilateral below-the-knee amputations because of infected ulcers of the feet. She uses a wheelchair for ambulation. Ten years ago, she underwent three-vessel coronary artery bypass grafting. She has smoked one-half pack of cigarettes daily for 60 years. She drinks one shot of whiskey nightly. She is thin and appears ill and disheveled. Her temperature is 37.2°C (99.0°F), pulse is 80/min, respirations are 20/min, and blood pressure is 120/80 mm Hg. Pulse oximetry on 2 L/min of oxygen by nasal cannula shows an oxygen saturation of 95%. Physical examination shows temporal wasting. There are scattered ecchymoses over the abdomen and all extremities. No other abnormalities are noted. Which of the following is the most appropriate initial history to obtain from this patient?

- (A) Abnormal bleeding
- (B) Diet
- (C) Relationship with her family
- (D) Respiratory symptoms
- (E) Urinary symptoms

**Correct Answer:**

- (C) Relationship with her family

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The patient presents with multiple 'red flags' for elder mistreatment (abuse or neglect). Key indicators include: 1) Physical signs of neglect: She is described as 'thin,' 'disheveled,' and 'ill-appearing' with 'temporal wasting' (a sign of protein-calorie malnutrition). 2) Physical signs of potential abuse: She has 'scattered ecchymoses' over the abdomen and extremities; while bruising on the shins is common in the elderly, bruising on the abdomen is highly suspicious for non-accidental trauma. 3) Risk factors: She has dementia and significant physical disability (bilateral amputations), making her entirely dependent on caregivers. 4) Social context: The caregivers' statement ('do the best we can') often reflects caregiver burnout or stress, which is a known trigger for neglect. While other options like 'Diet' (B) or 'Abnormal bleeding' (A) might address specific findings like wasting or bruising, they do not address the underlying safety of the patient. In a patient with these findings, the physician's priority is to screen for elder abuse by interviewing the patient alone and asking about her living situation and relationships. Therefore, assessing her relationship with her family is the most appropriate initial step in the history to ensure her safety and identify potential mistreatment.

## Question 107.1

An investigator is studying the impact of glucocorticoids on leukocyte dynamics in an experimental animal model. After dexamethasone administration, the total number of circulating neutrophils increases. Most of the additional neutrophils in circulation are detached; these neutrophils were previously loosely adherent and rolling along the endothelium. The expression of which of the following cell adhesion molecules is most likely decreased in this animal model after dexamethasone administration?

- (A) Cadherin
- (B) Intercellular adhesion molecule-1
- (C) L-selectin
- (D) MAC-1
- (E) Very late antigen-4

**Correct Answer:**

(C) L-selectin

**Neural Consult Response and Explanation:**



**Answer:** C

**Explanation:** Glucocorticoids like dexamethasone cause neutrophilia primarily through a process called 'demargination.' In the normal physiological state, a significant portion of the total neutrophil pool is 'marginalized,' meaning these cells are loosely adherent and rolling along the vascular endothelium rather than circulating freely. This rolling is mediated by selectins (L-selectin on neutrophils, and E-selectin/P-selectin on endothelial cells). Glucocorticoids induce the shedding of L-selectin (CD<sub>62</sub>L) from the surface of neutrophils and inhibit the expression of endothelial selectins. When L-selectin expression is decreased or the molecule is shed, neutrophils lose their ability to tether and roll along the vessel wall. Consequently, these previously marginalized cells detach and enter the main bloodstream, increasing the measured circulating neutrophil count. While glucocorticoids also decrease the expression of ICAM-1 (which is involved in firm adhesion), the specific description of neutrophils that were 'loosely adherent and rolling' and then 'detached' points directly to a disruption in the rolling phase of leukocyte recruitment, which is the hallmark of selectin-mediated interactions. Therefore, a decrease in L-selectin expression/availability is the most specific mechanism for the detachment of the rolling pool.

## Question 108.1

A 67-year-old man comes to the office because he is concerned about memory loss. He says he sometimes forgets the names of acquaintances he sees while he is out shopping. He also has occasional word-finding difficulty and forgets to buy some items when he goes shopping unless he makes a list. He lives alone and is able to manage his finances, cook, and shop without help. He works part-time as an accountant. He has gastroesophageal reflux disease and hypertension. Current medications are hydrochlorothiazide and omeprazole. Vital signs are within normal limits. Physical and neurologic examinations show no abnormalities. On mental status examination, he is fully oriented. His speech is normal, and thoughts are organized. His mood is euthymic, and he has a full range of affect. His concentration is intact, and he is able to perform calculations quickly and accurately. He can name objects accurately and follow written and verbal commands. He recalls three of four objects after 5 minutes. Which of the following is the most appropriate physician response to this patient's concern?

- (A) "I am concerned about your memory loss. Let's discuss how to further evaluate your memory."
- (B) "There's no need to worry right now, but let's meet again in 6 months."
- (C) "Unfortunately, your memory loss will likely increase significantly during the next 5 years; let's discuss some ways to plan for the future."
- (D) "Your episodes of forgetfulness are likely just 'Senior Moments,' but we should obtain in-depth laboratory test results and an MRI to be certain."
- (E) "Your examination findings indicate that your memory loss is likely consistent with the normal aging process."



## Correct Answer:

(E) "Your examination findings indicate that your memory loss is likely consistent with the normal aging

## Neural Consult Response and Explanation:

**Answer:** E

**Explanation:** The patient's presentation is characteristic of normal age-related cognitive decline rather than Mild Cognitive Impairment (MCI) or dementia. The key distinguishing factor is the preservation of functional independence; the patient manages his own finances, works as an accountant, and lives alone without assistance. In normal aging, individuals may experience occasional word-finding difficulties and a slight decrease in the speed of information processing or episodic memory (e.g., forgetting names or needing a shopping list), but these do not interfere with daily life. On objective mental status examination, his performance is excellent: he is oriented, can perform complex calculations quickly, and recalled 3 out of 4 objects after a delay, which is within the normal range for his age. Option A and B are incorrect because they imply a pathological process requiring further investigation or close monitoring. Option C is incorrect as it predicts a trajectory for dementia, which is not supported by the current findings. Option D is incorrect because, while the term 'senior moments' is colloquial, the recommendation for an MRI and in-depth labs is not indicated for a patient with a normal physical exam, normal mental status exam, and no functional impairment.

## Question 109.1

A 30-year-old woman comes to the office because of a 4-day history of an increasingly severe, painful rash over her body and in her mouth. The rash began over her trunk area but spread within a day to her face and extremities. Two days before development of the rash, she had flu-like symptoms with muscle aches and fatigue as well as a nonproductive cough, sore throat, and runny nose. Ten days ago, she began treatment with trimethoprim- sulfamethoxazole for a urinary tract infection; she takes no other medications. Temperature is 39.0°C (102.2°F), pulse is 120/min, respirations are 25/min, and blood pressure is 165/105 mm Hg. Physical examination shows diffuse brownish red macular exanthema with bullous lesions. Epidermis at an uninvolved site can be removed with mild tangential pressure. Examination of a biopsy specimen of one of the lesions shows necrosis of keratinocytes throughout the epidermis. There is minimal lymphocytic infiltration within the superficial dermis. Which of the following is the most likely diagnosis?

- (A) Erythema multiforme
- (B) Linear IgA bullous dermatosis
- (C) Pemphigus vulgaris
- (D) Staphylococcal scalded skin syndrome
- (E) Toxic epidermal necrolysis

## Correct Answer:

(E) Toxic epidermal necrolysis



## Neural Consult Response and Explanation:

**Answer:** E

**Explanation:** The patient's clinical presentation is highly characteristic of Toxic Epidermal Necrolysis (TEN). The timeline is classic: she started trimethoprim-sulfamethoxazole (a common sulfonamide trigger) 10 days prior, followed by a viral-like prodrome (fever, cough, sore throat), and then a rapidly progressive, painful bullous rash. The physical exam finding of a positive Nikolsky sign (epidermis sloughing with mild pressure) indicates a loss of epidermal integrity. Crucially, the biopsy showing full-thickness necrosis of keratinocytes with minimal dermal inflammation is the histopathological hallmark of the SJS/TEN spectrum. While Stevens-Johnson Syndrome (SJS) and TEN are on the same spectrum, the rapid spread to the face and extremities and the severity of the systemic symptoms suggest TEN (typically defined as >30% body surface area involvement). Erythema multiforme (A) usually presents with targetoid lesions and less extensive necrosis. Linear IgA bullous dermatosis (B) and Pemphigus vulgaris (C) are autoimmune blistering diseases with specific immunofluorescence patterns and lack the full-thickness epidermal necrosis seen here. Staphylococcal scalded skin syndrome (D) typically affects younger children and involves superficial cleavage at the granular layer of the epidermis due to exotoxins, rather than full-thickness necrosis.

## Question 110.1

A 45-year-old woman comes to the office for a follow-up examination 2 weeks after she sustained a vertebral fracture at L<sub>1</sub>. The fracture occurred spontaneously and there is no history of trauma to the area or other fractures. She gained 27 kg (60 lb) during the 6 months before the fracture occurred. Her only medication is hydromorphone as needed for pain. She is 163 cm (5 ft 4 in) tall and now weighs 100 kg (220 lb); BMI is 38 kg/m<sup>2</sup>. Temperature is 37.0°C (98.6°F), pulse is 86/min, respirations are 12/min, and blood pressure is 145/98 mm Hg. Physical examination shows central obesity and purple striae over the abdomen bilaterally. The lower extremities appear thin. Results of laboratory studies are shown:

Plasma Renin activity 5.0 ng/mL/hr (N=0.6–4.0) Metanephrine 0.3 nmol/L (N<0.4) Serum Cortisol, random 43 µg/dL

Adrenocorticotropic hormone 120 pg/mL (N<120) Aldosterone 8 ng/dL (N=2–9) Urine 24-hour free cortisol excretion 340 µg/24 h (N=3.5–45)

The most likely cause of the fracture in this patient is an increase in which of the following processes?

- (A) Calcium absorption
- (B) Calcium excretion
- (C) Osteoblast proliferation
- (D) Osteoclast proliferation
- (E) Phosphorus absorption
- (F) Phosphorus excretion

**Correct Answer:**



## (D) Osteoclast proliferation

### Neural Consult Response and Explanation:

**Answer:** D

**Explanation:** The patient presents with classic signs of Cushing syndrome, including central obesity, purple striae, hypertension, and thin extremities. This is confirmed by laboratory evidence of hypercortisolism (elevated 24-hour urinary free cortisol and random serum cortisol) and an elevated ACTH level, suggesting ACTH-dependent Cushing syndrome. Glucocorticoid excess is a potent cause of secondary osteoporosis and fragility fractures, such as the spontaneous L<sub>1</sub> vertebral fracture seen here. The pathophysiology of glucocorticoid-induced osteoporosis is multifactorial but primarily involves a shift in the bone remodeling balance. Glucocorticoids directly stimulate osteoclastogenesis (increasing osteoclast proliferation and activity) by increasing the expression of RANK ligand (RANKL) and decreasing the expression of osteoprotegerin (OPG). Simultaneously, they inhibit osteoblast proliferation, promote osteoblast apoptosis, and decrease the production of bone matrix. While glucocorticoids also decrease intestinal calcium absorption and increase renal calcium excretion (leading to secondary hyperparathyroidism which further stimulates osteoclasts), the direct cellular effect on bone—specifically the increase in osteoclast-mediated resorption—is the primary driver of the rapid bone loss and subsequent fracture. Therefore, an increase in osteoclast proliferation is the most likely cause among the choices provided.

### Question 111.1

A 25-year-old woman comes to the emergency department because of a 3-hour history of fever, severe headache, light-headedness, dizziness, shaking chills, and muscle aches. Five hours ago, she was diagnosed with Lyme disease and began doxycycline therapy. She has no other history of serious illness and takes no other medications. Menses occur at regular 28-day intervals. She is currently menstruating and using a tampon. She appears anxious. Temperature is 37.0°C (98.6°F), pulse is 120/min, respirations are 30/min, and blood pressure is 90/60 mm Hg. Pulse oximetry on room air shows an oxygen saturation of 94%. Physical examination shows flushing and diaphoresis. Cardiopulmonary examination shows no other abnormalities. Which of the following is the most likely mechanism of this patient's current condition?

- (A) Exacerbation of infection by *Borrelia burgdorferi*
- (B) Infection-mediated sepsis
- (C) IgE-mediated allergic reaction to doxycycline
- (D) Release of bacterial products producing acute inflammation
- (E) Secretion of bacterial endotoxins

### Correct Answer:

- (D) Release of bacterial products producing acute inflammation

### Neural Consult Response and Explanation:



**Answer:** D

**Explanation:** The patient's clinical presentation is classic for a Jarisch-Herxheimer reaction (JHR). This is an acute inflammatory response that occurs shortly after starting antimicrobial therapy for certain infections, most notably spirochetal infections like Lyme disease (*Borrelia burgdorferi*) or syphilis (*Treponema pallidum*). The timing (symptoms starting 2 hours after the first dose of doxycycline), the symptoms (fever, chills, headache, myalgias), and the physical findings (tachycardia, hypotension, flushing) are all hallmark features. The mechanism involves the rapid killing and lysis of spirochetes by the antibiotic, which leads to the massive release of bacterial products (such as lipoproteins and glycolipids). These products trigger a systemic inflammatory cascade, including the release of cytokines like TNF-alpha, IL-6, and IL-8, resulting in the observed symptoms. Option (A) is incorrect as this is a reaction to treatment, not a failure of it. Option (B) is incorrect because while it resembles sepsis, the specific trigger is the antibiotic-induced lysis of bacteria rather than the primary infection's progression. Option (C) is incorrect as JHR is not an IgE-mediated allergy; it lacks features like urticaria or angioedema. Option (E) is less accurate because *Borrelia burgdorferi* does not contain classic lipopolysaccharide (LPS) endotoxin found in Gram-negative bacteria; rather, it releases lipoproteins that act as the inflammatory trigger, making 'bacterial products' (Option D) the more precise description.

## Question 112.1

A 2-week-old male newborn is brought to the office for a well-child examination. He was delivered following an uncomplicated, spontaneous vaginal delivery at 41 weeks' gestation. The mother has no history of serious illness and did not receive prenatal care. Her only medication is a prenatal vitamin. She has consumed large amounts of vodka nightly for 10 years. Which of the following examination findings is most likely to be present in this patient?

- (A) Hypospadias
- (B) Limb hypoplasia
- (C) Neck webbing
- (D) Short palpebral fissures
- (E) Spasticity

**Correct Answer:**

- (D) Short palpebral fissures

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The clinical presentation describes a newborn with significant prenatal alcohol exposure, as the mother consumed large amounts of vodka nightly throughout the pregnancy. This history is highly suggestive of Fetal Alcohol Syndrome (FAS). FAS is characterized by a specific triad of physical findings: growth deficiency (prenatal or postnatal), central nervous system dysfunction, and a characteristic pattern of facial dysmorphism. The three cardinal facial features of FAS are short palpebral fissures (small eye openings), a smooth philtrum (loss of the vertical groove between the nose and upper lip), and a thin vermilion border (thin upper lip). Among the options provided, short palpebral fissures (D) is a classic diagnostic feature. Hypospadias (A) is not a primary feature of FAS. Limb hypoplasia (B) is more characteristic of conditions like thalidomide exposure or vascular accidents (e.g., cocaine use). Neck webbing (C) is a hallmark of Turner syndrome (45,X). While prenatal alcohol exposure can lead to neurodevelopmental delays and motor deficits later in life, spasticity (E) is not a common or specific finding in a 2-week-old with FAS; rather, it is more typical of cerebral palsy or specific upper motor neuron lesions.

### Question 115.1

A 15-year-old boy is brought to the office by his parents to discuss results of a biopsy done 3 days ago for a rapidly enlarging neck mass. He first noted the mass 1 month ago. Two weeks ago, he was evaluated for an episode of prolonged epistaxis and was found to have a right ear effusion, which was treated with amoxicillin-clavulanic acid. He has no other history of serious illness and takes no medications. Height is at the 10th percentile, weight is at the 50th percentile, and BMI is at the 75th percentile. Vital signs are within normal limits. Physical examination shows a right ear effusion and a 4-cm, firm mass in the right posterior triangle of the neck. Results of a biopsy specimen show squamous epithelium with indistinct cell margins, enlarged atypical nuclei, and absent keratin formation. Which of the following infectious agents is the most likely underlying cause of this patient's current condition?

- (A) Cytomegalovirus
- (B) Epstein-Barr virus
- (C) HIV
- (D) Human herpesvirus 8

**Correct Answer:**

- (B) Epstein-Barr virus

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The clinical presentation and histological findings in this 15-year-old patient are diagnostic of Nasopharyngeal Carcinoma (NPC). The triad of a firm neck mass (cervical lymphadenopathy), epistaxis, and a unilateral serous ear effusion (caused by Eustachian tube obstruction by the primary tumor in the Rosenmüller fossa) is the classic presentation for NPC. Histologically, the description of 'squamous epithelium with indistinct cell margins' (often referred to as a syncytial growth pattern) and 'absent keratin formation' identifies this as undifferentiated (Type 3) nasopharyngeal carcinoma. This specific malignancy has a nearly 100% association with Epstein-Barr virus (EBV) infection, regardless of the patient's geographic origin. EBV infects the nasopharyngeal epithelial cells and utilizes viral proteins like LMP<sub>1</sub> to promote cell survival and proliferation. Other options are incorrect: Cytomegalovirus (A) is not oncogenic in this context; HIV (C) can increase the risk of various malignancies but is not the direct causative agent of the squamous cell changes seen; and Human herpesvirus 8 (D) is associated with Kaposi sarcoma and primary effusion lymphoma, which present with vascular or lymphoid histology rather than squamous epithelium.

## Question 116.1

A 14-year-old boy is brought to the emergency department by his parents because of a 1-month history of intermittent right knee pain that has worsened during the past day. He rates his current pain as a 6 on a 10-point scale and says that it worsens when he walks and lessens when he sits. During the past 2 weeks, he has been walking 1 mile daily in preparation for participation in the school marching band. He has not taken any medications for his pain. He sustained a right tibia and fibula fracture at the age of 8 years after a skateboarding accident, which was treated with internal fixation and casting. He has asthma treated with inhaled budesonide daily and inhaled albuterol as needed. His mother has type 2 diabetes mellitus, and his maternal grandmother has osteoporosis. The patient is 170 cm (5 ft 7 in; 77th percentile) tall and weighs 88 kg (195 lb; >95th percentile); BMI is 31 kg/m<sup>2</sup> (98th percentile). Temperature is 37.0°C (98.6°F), pulse is 95/min, and blood pressure is 130/80 mm Hg. Physical examination shows hyperpigmented, thickened skin at the nape of the neck. There is tenderness to palpation of the anterior aspect of the right hip and limited range of motion on abduction, internal rotation, and flexion of the right hip. The left hip and knees are nontender; range of motion is full in all directions. The remainder of the examination discloses no abnormalities. Which of the following factors in this patient's history most increased his risk for developing this condition?

- (A) BMI
- (B) Family history
- (C) Medication use
- (D) Previous fractures
- (E) Recent physical activity

**Correct Answer:**

- (A) BMI

**Neural Consult Response and Explanation:**



**Answer:** A

**Explanation:** The patient's clinical presentation is classic for Slipped Capital Femoral Epiphysis (SCFE). He is an obese (BMI 31 kg/m<sup>2</sup>, >95th percentile) adolescent male presenting with referred knee pain and hip pain, accompanied by limited internal rotation and abduction of the hip. In SCFE, the femoral head slips posteriorly and inferiorly relative to the femoral neck through the physeal plate. Obesity is the most significant and well-documented risk factor for SCFE because the increased mechanical load (shear stress) on the growth plate, often combined with the hormonal changes associated with adipose tissue, predisposes the physis to displacement. While other factors like hypothyroidism or chronic steroid use (Option C) can increase risk, the patient's BMI is the most prominent risk factor in this scenario. Acanthosis nigricans (hyperpigmented, thickened skin on the neck) further confirms insulin resistance associated with his obesity. Previous fractures (Option D) and recent activity (Option E) do not predispose to the development of SCFE, and his family history (Option B) of diabetes and osteoporosis is less relevant than his own physical status.

## Question 117.1

A 38-year-old woman comes to the clinic to discuss results of a biopsy specimen of a mass in the right breast obtained 1 week ago. She has no history of serious illness and takes no medications. Vital signs are within normal limits. Examination of the right breast shows a well-healing biopsy incision. The remainder of the examination discloses no abnormalities. Results of the biopsy specimen disclose ductal carcinoma in situ. The physician informs the patient he has some bad news to share and tells her the diagnosis. He explains her treatment options, including mastectomy, breast-conserving surgery, radiation therapy, chemotherapy, and any combination of these options. The patient appears afraid but listens attentively before responding, "You're the doctor. My children are still little. Tell me what I should do." In addition to expressing empathy, which of the following is the most appropriate physician response?

- (A) "As the patient, you really should make any decision you feel is best for you."
- (B) "Before I make recommendations, can you tell me what you understand about your options?"
- (C) "Given the stage of the cancer, I recommend mastectomy."
- (D) "How important is it to you to keep your breasts?"
- (E) "Would you like to discuss these options further with your family?"
- (F) "Would you like to think your options over and schedule another visit to discuss them further?"
- (G) "You said you have young children. How old are they?"

**Correct Answer:**

- (B) "Before I make recommendations, can you tell me what you understand about your options?"

**Neural Consult Response and Explanation:**



**Answer: B**

**Explanation:** The patient is facing a diagnosis of ductal carcinoma in situ (DCIS), a condition where multiple treatment pathways (e.g., breast-conserving surgery with radiation vs. mastectomy) often yield equivalent survival outcomes. In such 'preference-sensitive' scenarios, shared decision-making is the gold standard. The patient's response ('Tell me what I should do') indicates she is overwhelmed and attempting to defer the decision entirely to the physician (paternalism). Before a physician can provide a recommendation or explore the patient's values, they must ensure the patient has a baseline understanding of the medical facts provided. Option B utilizes a technique similar to the 'teach-back' method, which assesses the patient's comprehension and identifies gaps or misconceptions. This step is foundational; if the patient does not understand that the options have similar survival rates, she cannot effectively weigh them against her personal values (like her concern for her children). Options A and C represent extremes of abandoning the patient or being overly paternalistic. Options D, E, F, and G, while potentially useful later in the conversation, do not address the immediate need to establish a shared understanding of the clinical situation before moving toward a treatment choice.

### Question 118.1

A 36-year-old woman with hypertension comes to the office because she thinks she may be “going through early menopause.” She has not had a menstrual period since her most recent office visit 6 months ago. During this time, she also has been “gaining weight around the middle” despite increased exercise; she has had a 6.3-kg (14-lb) weight gain. She has no other history of major medical illness. Her only medication is lisinopril. She does not smoke, drink alcohol, or use illicit drugs. She is 168 cm (5 ft 6 in) tall and weighs 107 kg (236 lb); BMI is 38 kg/m<sup>2</sup>. Vital signs are within normal limits. Examination shows a uterus consistent in size with a 24-week gestation. Pelvic ultrasonography shows oligohydramnios and a fetus with a misshapen cranium, pericardial effusion, small bladder, and echogenic bowel. The most likely cause of the fetal abnormalities in this patient's pregnancy is interference with which of the following?

- (A) Fetal lung/epithelial differentiation
- (B) Fetal lung/surfactant development
- (C) Fetal renal hemodynamics
- (D) Maternal placental perfusion
- (E) Maternal prostaglandin synthesis

**Correct Answer:**

- (C) Fetal renal hemodynamics

**Neural Consult Response and Explanation:**



**Answer: C**

**Explanation:** The patient is presenting with ACE inhibitor fetopathy, a condition caused by the use of lisinopril during the second and third trimesters of pregnancy. The clinical presentation of a 24-week gestation (indicated by the uterine size) with oligohydramnios, a small bladder, and a misshapen cranium (calvarial hypoplasia) is classic for this condition. ACE inhibitors cross the placenta and interfere with the fetal renin-angiotensin-aldosterone system (RAAS). In the fetus, angiotensin II is essential for maintaining renal perfusion and the glomerular filtration rate (GFR). By blocking the conversion of angiotensin I to angiotensin II, lisinopril causes fetal hypotension and renal hypoperfusion. This leads to fetal renal failure and decreased urine production, which manifests as oligohydramnios (low amniotic fluid). The lack of amniotic fluid leads to Potter sequence-like features, including a misshapen cranium due to uterine pressure on the fetus without the cushioning effect of the fluid. Therefore, the primary mechanism of these abnormalities is the interference with fetal renal hemodynamics.

### Question 119.1

A 25-year-old woman, gravida 1, para 1, comes to the office because of a 2-week history of palpitations and heat intolerance. She delivered her child 3 months ago following an uncomplicated pregnancy and delivery. She is breast-feeding. She has no history of serious illness and takes no medications. She is 163 cm (5 ft 4 in) tall and weighs 54 kg (120 lb); BMI is  $21 \text{ kg/m}^2$ . Temperature is  $37^\circ\text{C}$  ( $98.6^\circ\text{F}$ ), pulse is 106/min, respirations are 20/min, and blood pressure is 124/68 mm Hg. Examination shows moist palms and bilateral lid lag. No exophthalmos is noted. The thyroid gland is enlarged and nontender. No murmurs are heard on cardiac examination. Deep tendon reflexes are 3+. Serum studies show an undetectable TSH concentration, thyroxine ( $T_4$ ) concentration of  $20 \text{ }\mu\text{g/dL}$ , and triiodothyronine ( $T_3$ ) concentration of  $275 \text{ ng/dL}$ . Which of the following is the most likely mechanism of this patient's symptoms?

- (A) Activation of mutations of TSH receptors
- (B) Increased serum thyroglobulin concentration
- (C) Ischemic injury to the hypothalamus
- (D) Lymphocytic infiltration of the thyroid
- (E) Presence of TSH receptor autoantibodies

**Correct Answer:**

(D) Lymphocytic infiltration of the thyroid

**Neural Consult Response and Explanation:**



**Answer:** D

**Explanation:** The patient presents with symptoms of thyrotoxicosis (palpitations, heat intolerance, tachycardia, lid lag, and hyperreflexia) and laboratory evidence of overt hyperthyroidism (undetectable TSH, elevated  $T_3$  and  $T_4$ ) three months after delivery. The most likely diagnosis is postpartum thyroiditis (PPT). PPT is a variant of silent (painless) thyroiditis that occurs within one year of delivery.

Pathologically, it is characterized by a destructive autoimmune process involving lymphocytic infiltration of the thyroid gland. This infiltration leads to the destruction of thyroid follicles and the subsequent release of preformed thyroid hormone into the circulation, causing a transient thyrotoxic phase. The thyroid gland is typically enlarged and nontender, as seen in this patient. Option (E), TSH receptor autoantibodies, is the mechanism for Graves' disease. While Graves' can occur postpartum, the absence of exophthalmos and the classic timing of PPT make lymphocytic infiltration (D) the more likely mechanism for this specific presentation. Option (A) refers to toxic multinodular goiter or adenomas. Option (B) is a marker of thyroid tissue destruction or activity but not the primary mechanism. Option (C) refers to Sheehan syndrome, which would cause hypothyroidism (low TSH and low  $T_4$ ), not hyperthyroidism.

