NBCRNA CRNA - Quiz Questions with Answers

I. Basic Sciences

1.

Which medication is best used for routine aspiration prophylaxis?

- **Aspiration prophylaxis should not be routinely used**
- Antacids
- Proton pump inhibitors
- Histamine blockers

Correct answer: Aspiration prophylaxis should not be routinely used

Routine aspiration prophylaxis is not supported by scientific evidence. However, practitioners may administer them when indicated to patients at risk of aspiration.

2.

Malignant hyperthermia is suspected in a patient weighing 154 pounds. Which of the following represents the correct starting dose of dantrolene (Ryanodex, Dantrium) to be administered?

175 mg

70 mg

1.4 mg

140 mg

Correct answer: 175 mg

The correct starting dose of dantrolene (Ryanodex, Dantrium) is 2.5 mg/kg.

- *154 pounds = 70 kg*
- *1 kg = 2.2 pounds*
- *154 / 2.2 = 70*
- *70 x 2.5 = 175 mg*

3.

A patient presenting with gallbladder disease is most likely to present with abnormal findings in which of the following laboratory values?

Alkaline phosphatase and serum bilirubin

Total bilirubin and total protein

Serum bilirubin and alanine transaminase

Amylase and alanine transaminase

Correct answer: Alkaline phosphatase and serum bilirubin

Gallbladder disease, or cholecystitis, typically is caused by the presence of gallstones (cholelithiasis) either within the gallbladder itself or within the ductal network in 90% to 95% of cases. The other 5% to 10% of cholecystitis cases are caused by non-stone-related concerns, such as malignancies. Patients who present with cholecystitis are most likely to experience an increase in serum bilirubin, alkaline phosphatase, and amylase levels. Increases in the more liver-specific laboratory studies, such as total protein and alanine transaminase, are more likely to occur in patients with true liver disorders.

4.

In which of the following types of hypersensitivity reactions do circulating soluble antigens and antibodies bind to form insoluble complexes that deposit in microvasculature?

Type III

Type I

Type II

Type IV

Correct answer: Type III

In Type III hypersensitivity reactions, circulating soluble antigens and antibodies bind to form insoluble complexes that deposit in microvasculature.

In Type I hypersensitivity reactions, mediators are released from mast cells and basophils after the antigen binds to IgE antibodies on cell membranes. Type II hypersensitivity reactions are antibody-dependent cell-mediated cytotoxic hypersensitive reactions, IgG or IgM-mediated. Type IV hypersensitivity reactions are characterized by interactions of sensitized cytotoxic T-cells with specific antigens or delayed sensitivity reactions.

5.

When should tricyclic antidepressants generally be used to manage cancer pain?

For neuropathic pain that is refractory to opioids

As the primary choice for neuropathic pain

As an adjunct pain medication for any type of cancer pain

Tricyclic antidepressants should not be used to manage pain, only to manage psychological symptoms

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Correct answer: For neuropathic pain that is refractory to opioids

Tricyclic antidepressants are conventionally used in cancer patients to treat neuropathic pain that is refractory to opioids. Tricyclic antidepressants are not conventionally used for any kind of pain but can be used for neuropathic pain in addition to psychological indications.

6.

Which are most likely to be triggers for a sickle cell crisis in a patient with sickle cell disease? (Select 3.)

- **Infection**
- **Venous stasis**
- **Dehydration**
- Alkalosis
- Hyperthermia

Sickle cell crisis is triggered by conditions that increase the concentration of red blood cells, the stasis of red blood cells, or inflammation. Infection, venous stasis, and dehydration can all trigger sickle cell disease.

Acidosis (not alkalosis) and hypothermia (not hyperthermia) are sickle cell triggers.

7.

Which of the following is normal cerebral perfusion pressure (CPP)?

60 to 150 mmHg

> 150 mmHg

75 mmHg

25 to 50 mmHg

Correct answer: 60-150 mmHg

Cerebral perfusion pressure (CPP) is the difference between mean arterial pressure (MAP) and intracranial pressure (ICP) [or central venous pressure (CPV), whichever is greater]. Young, healthy adults typically possess a CPP that falls within a range of 60 mmHg to 150 mmHg. Individuals with co-existing morbidities, such as chronic uncontrolled hypertension, will typically demonstrate a higher minimum CPP, which is necessary to sustain adequate cerebral blood flow.

CPP is normally 60 to150 mmHg. Patients with CPP values less than 50 mmHg often show slowing on electroencephalogram (EEG). Those with CPP values between 25 and 40 mmHg typically have a flat EEG. Sustained perfusion pressure of less than 25 mmHg results in irreversible brain damage.

8.

Which of the following characteristics of remifentanil has increased the frequency with which it is used in anesthesia and which makes it most useful during surgery?

Remifentanil has a rapid onset of action and is rapidly metabolized

Remifentanil has a rapid onset of action and a longer duration of action

Remifentanil has a longer duration of action, and its metabolism is not impaired by concurrent administration of succinylcholine

Remifentanil can be used concurrently with succinylcholine and is slightly more potent than fentanyl

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Correct answer: Remifentanil has a rapid onset of action and is rapidly metabolized

Remifentanil is one of the several examples of engineered narcotics that have been designed with specific patient needs in mind. Its rapid onset coupled with rapid metabolism makes for a half-life of approximately 8 to 20 minutes, making it the ideal drug for titrating both up and down when needed. Remifentanil can be safely used with the concurrent administration of succinylcholine. Its potency is slightly less than that of fentanyl.

9.

The anion gap is used when attempting to identify the type and cause of which of the following conditions?

Metabolic acidosis

Metabolic alkalosis

Respiratory acidosis

Respiratory alkalosis

Correct answer: Metabolic acidosis

The two major forms of acidosis are respiratory or metabolic in origin. Metabolic acidosis occurs as a consequence of buffering by bicarbonate of endogenous or exogenous acid loads or as a consequence of abnormal external loss of bicarbonate. Calculation of the anion gap distinguishes between the two types of metabolic acidosis. Metabolic acidosis with a high anion gap occurs because of excess production or decreased excretion of organic acids or ingestion of one of several toxic compounds.

The anion gap is normal in situations such as diarrhea, biliary drainage, and renal tubular acidosis in which bicarbonate is lost externally. The anion gap is also normal or reduced in hyperchloremic acidosis associated with perioperative infusion of substantial amounts of 0.9% normal saline.

10.

Functional residual capacity is the combination of residual volume and what other factor?

Expiratory reserve volume

Tidal volume

Inspiratory reserve volume

Chest wall compliance

Correct answer: Expiratory reserve volume

Residual volume plus expiratory reserve volume equals functional residual capacity (RV + ERV = FRC). Functional residual capacity is the lung volume at the end of normal exhalation. At this volume, the inward elastic recoil of the lung approximates the outward elastic recoil of the chest, including resting diaphragmatic tone.

11.

Diazepam can be administered by any of the following routes except:

Intrathecal

Intranasal

Buccal

Sublingual

Correct answer: Intrathecal

Diazepam is a benzodiazepine. These medications may be appropriately administered via any route except intrathecally. However, because diazepam and lorazepam are hydrophobic, they must be dissolved in propylene glycol for parenteral administration. Propylene glycol is extremely irritating to veins, so venous irritation is associated with injection of these benzodiazepines.

12.

A 1-degree Celsius change in temperature will result in a linear change in cerebral blood flow of which of the following?

7%

2%

10%

1%

Correct answer: 7%

A 1-degree Celsius change in temperature will result in a 7% linear change in cerebral blood flow.

Cerebral metabolism decreases exponentially with a reduction in temperature. On average, the Cerebral Metabolic Rate of oxygen (CMRO2) decreases by 7% for each degree Celsius decrease in body temperature.

13.

All the following are physiological effects of acidemia except:

Increased cardiac contractility

Decreased peripheral vascular resistance

Decreased threshold for ventricular fibrillation

Progressive hypotension

Correct answer: Increased cardiac contractility

With acidemia, direct depressant effects of hydrogen are seen. Direct myocardial and smooth muscle depression reduces cardiac contractility and peripheral vascular resistance, resulting in progressive hypotension.

Both cardiac and vascular smooth muscle become less responsive to endogenous and exogenous catecholamines, and the threshold for ventricular fibrillation is decreased.

14.

Which complications are a patient with diabetes mellitus more likely to experience following surgery? (Select 3.)

Cardiac ischemia

Sepsis

Wound infection

Pancreatitis

Laryngospasms

Diabetes mellitus increases the risk of hyperglycemia in the postoperative period. Hyperglycemia is associated with cardiovascular events and with an increased risk of infectious processes, such as wound infection and sepsis. Pancreatitis and laryngospasms are not common postoperative complications caused by hyperglycemia.

15.

Which of the following terms used in research describes the most frequently occurring number in the sample?

Mode

Mean

Median

Variance

Correct answer: Mode

The mode is the value that occurs most frequently in a sample.

The mean is the mathematical average of the sample. The median is the point at which half the measurements in the sample are above and half the measurements are below. Variance is the square of the sum of all the deviations divided by the number of scores.

16.

Which of the following is the greatest concern with the abrupt discontinuation of clonidine?

Hypertension

Intractable pain

Cardiac dysrhythmias

Tachycardia

Correct answer: Hypertension

Clonidine is an alpha2-adrenergic agonist and is used to treat hypertension. Abrupt discontinuation of clonidine can cause a significant risk of rebound hypertension. Intractable pain, cardiac dysrhythmias, and tachycardia are all not common concerns with the abrupt discontinuation of clonidine.

17.

Which of the following statements is true about patients on long-term angiotensin-converting enzyme inhibitor therapy who undergo general surgery?

They are at risk for intraoperative hypotension due to decreased cardiac output

They are at risk for intraoperative hypertension

The renin-angiotensin-aldosterone system is the only system intact to support blood pressure

The angiotensin-converting enzyme inhibitor decreases the risk of prolonged hypotension by blunting the renin-angiotensin-aldosterone system

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Correct answer: They are at risk for intraoperative hypotension due to decreased cardiac output

Surgical patients who are on long-term Angiotensin-Converting Enzyme (ACE) inhibitor therapy are at risk for prolonged hypotension during general anesthesia due to the increased venoconstrictive effects of angiotensin on the capacitance vessels, which decreases cardiac output.

Patients on long-term ACE inhibitor therapy are at risk for intraoperative hypotension, rather than hypertension. The vasopressin system, rather than the renin-angiotensin-aldosterone system, is the only system intact to support blood pressure. The ACE inhibitor increases, rather than decreases, the risk for prolonged hypotension because it may cause blunting of the renin-angiotensin-aldosterone system.

18.

Which of the following statements best describes unfractionated heparin's mechanism of action?

Unfractionated heparin binds to antithrombin and causes a change that greatly increases antithrombin's inhibitory activity

Unfractionated heparin competes with vitamin K for the carboxylation binding sites, leading to the depletion of factors II, VII, IX, X, protein C, and protein S

Unfractionated heparin decreases the activity of a second native antithrombin, heparin cofactor II

Unfractionated heparin inhibits both unbound and fibrin-bound thrombin

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Correct answer: Unfractionated heparin binds to antithrombin and causes a change that greatly increases antithrombin's inhibitory activity

Unfractionated heparin is used widely for anticoagulation in vascular surgery and in procedures requiring cardiopulmonary bypass. It inhibits coagulation principally through its interaction with antithrombin.

Warfarin, not unfractionated heparin, competes with vitamin K for the carboxylation binding sites, leading to the depletion of factors II, VII, IX, X, protein C, and protein S. Unfractionated heparin increases (not decreases) the activity of a second native antithrombin, heparin cofactor II. Direct thrombin inhibitors, (not unfractionated heparin) inhibit both unbound and fibrin-bound thrombin.

19.

How is a 25% reduction in hepatic blood flow typically compensated?

Modulation of hepatic artery tone

A 25% reduction in hepatic blood flow cannot be compensated

Modulation of portal vein tone

Modulation of systemic vascular tone

Correct answer: Modulation of hepatic artery tone

Modulation of hepatic artery tone is the primary means of compensating for the reduction in hepatic blood flow and can compensate for reductions in hepatic blood flow of up to 50%. Portal vein flow is not regulated. Modulation of systemic vascular tone is not the primary means of regulating hepatic blood flow.

20.

Which of the following effects results from H1 receptor stimulation? (Select 2.)

- **Increased capillary permeability**
- **Intestinal contraction**
- Bronchodilation
- Positive inotropic effects
- Increased gastric acid production

Histamine receptors include H1 receptors and H2 receptors. Increased capillary permeability, intestinal contraction, and bronchoconstriction are all results of H1 receptor stimulation. H2 receptor stimulation results in positive inotropic effects and increased gastric acid production.

21.

Which of the following patients is at risk for increased bleeding as a result of factor VIII deficiency?

Patient with a history of hemophilia A

Patient with a history of Christmas disease

Patient with a history of hemophilia B

Patient with a history of Rosenthal disease (hemophilia C)

Correct answer: Patient with a history of hemophilia A

Within the United States, millions of people are affected by bleeding disorders. The more common of these disorders include hemophilia and von Willebrand disease, as well as other factor deficiencies. The hemophilias are X-linked recessive disorders, affecting males more often than females, and typically result in unforeseeable bleeding patterns. Hemophilia A results from a deficiency of factor VIII, while hemophilia B (also called Christmas disease) results from a deficiency of factor IX.

Rosenthal disease (also called hemophilia C) is an autosomal recessive disorder often affecting the Ashkenazi Jewish and Basque populations more heavily. It is characterized by a prolongation of the aPTT. Von Willebrand disease may be inherited or acquired and may demonstrate various characteristics dependent upon the subtype of the disease.

22.

Which of the following are direct thrombin inhibitors? (Select 3.)

Argatroban

Bivalirudin

Desirudin

Fondaparinux

Ticlopidine

Argatroban, bivalirudin, and desirudin are all direct thrombin inhibitors. Fondaparinux is a heparin and ticlopidine is an antiplatelet agent, specifically a P2Y12 receptor antagonist.

23.

Which of the following antibiotics contain β-lactams rings in their chemical structure? (Select 3.)

- **Cephalosporins**
- **Carbapenems**
- **Monobactams**
- Vancomycin
- Clindamycin

β-lactam antibiotics include cephalosporins, carbapenems, and monobactams. Vancomycin and clindamycin are both not β-lactam antibiotics.

24.

All the following steps in the research process must be completed before an approach for testing the hypothesis is developed except:

Analysis and interpretation of the data

Identification of the problem

Review of the relevant knowledge and literature

Formulation of the hypothesis

Correct answer: Analysis and interpretation of the data

Analysis and interpretation of data will be completed after the development of an approach for testing the hypothesis and execution of the research plan.

Before the development of an approach for testing the hypothesis, the problem must be identified, a review of the relevant knowledge and literature must be completed, and the hypothesis must be formulated.

25.

Which of the following can be used to reverse the effects of a direct oral anticoagulant?

Andexanet alfa

Protamine

Vitamin K

Platelet transfusion

Correct answer: Andexanet alfa

Antidotes to direct oral anticoagulants include andexanet alfa and idarucizumab. Protamine can neutralize heparin, not direct oral anticoagulants. Vitamin K is used to reverse warfarin and platelet transfusions are used to treat thrombocytopenia.

26.

Possible causes of adrenal gland destruction include all the following except:

Diabetic ketoacidosis

Fungal infections

Bacterial infections

Hemorrhagic shock

Correct answer: Diabetic ketoacidosis

Diabetic ketoacidosis is not associated with adrenal gland destruction.

The primary cause of adrenal insufficiency is autoimmune destruction of the adrenal gland. Other possible causes include:

- *Certain bacterial, fungal, and viral infections (advanced HIV)*
- *Metastatic cancer*
- *Sepsis*
- *Hemorrhage*

27.

Which of the following statements is true about adenosine when used as part of cardiovascular testing?

It is used as a coronary vasodilator to assess flow heterogeneity for patients who are unable to exercise

It increases myocardial oxygen demands by increasing heart rate and blood pressure in patients who cannot exercise

It quickly produces maximal hyperemia in patients who are unable to exercise

Using adenosine for stress testing in patients who cannot exercise provides anatomic rather than functional information

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Correct answer: It is used as a coronary vasodilator to assess flow heterogeneity for patients who are unable to exercise

Adenosine is administered to patients who are unable to exercise as a coronary vasodilator to assess flow heterogeneity. The presence of a redistribution defect is predictive of postoperative cardiac events, especially in patients undergoing peripheral vascular surgery.

Dobutamine increases myocardial oxygen demands by increasing heart rate and blood pressure. Lexiscan, not adenosine, quickly produces maximal hyperemia. Unlike exercise or pharmacological stress testing, coronary angiography provides anatomic rather than functional information. Stress tests provide functional information.

28.

All the following may stimulate the release of antidiuretic hormone except:

Decrease in serum osmolality

Increased anxiety

Positive-pressure ventilation of the lungs

Hyperthermia

Correct answer: Decrease in serum osmolality

The secretion of antidiuretic hormone (ADH), also known as vasopressin, is stimulated by increased serum osmolality (not decreased) because the increase indicates insufficient water content.

ADH secretion may also be stimulated by the following:

- *Beta-adrenergic stimulation*
- *Stress and anxiety*
- *Hyperthermia*
- *Histamine-releasing stimuli*
- *Positive-pressure ventilation*

29.

In pulmonary function testing, which of the following is considered normal adult vital capacity?

60 - 70 mL/kg

40 - 50 mL/kg

90 - 100 mL/kg

110 - 125 mL/kg

Correct answer: 60 - 70 mL/kg

Normal Vital Capacity (VC) in pulmonary function testing is the maximum volume of gas that can be exhaled following maximal inspiration. Normal VC is about 60 - 70 mL/kg.

30.

Which of the following will not reduce cerebral edema?

Decompressive craniectomy

Furosemide

Mannitol

Hypertonic saline

Correct answer: Decompressive craniectomy

A decompressive craniectomy will reduce intracranial pressure caused by cerebral edema, but will not reduce cerebral edema itself. Furosemide, hypertonic saline, and mannitol are all possible therapeutics for reducing cerebral edema.

31.

Which type of glaucoma is commonly described as acute glaucoma?

Angle-closure glaucoma

Open-angle glaucoma

Infantile glaucoma

Congenital glaucoma

Correct answer: Angle-closure glaucoma

Angle-closure glaucoma is also referred to as acute glaucoma. Open-angle glaucoma generally refers to chronic glaucoma. Infantile glaucoma is a rare developmental defect. Congenital glaucoma is generally a component of other congenital conditions.

32.

Which of the following are absolute contraindications to neuraxial analgesia? (Select 2.)

Patient inability to maintain stillness during needle puncture

Elevated intracranial pressure

Chronic low back pain without a neurologic deficit

Spinal stenosis

History of spine surgery

The inability to maintain stillness during needle puncture is an absolute contraindication to neuraxial analgesia due to the risk of traumatic injury to the neural structures. Elevated intracranial pressure carries an increased risk of brainstem herniation and is considered an absolute contraindication, as well. Chronic low back pain without a neurologic deficit, spinal stenosis, and a history of spine surgery are all relative contraindications to neuraxial analgesia.

33.

Type 2 diabetics can experience all the following except:

A complete absence of endogenous insulin production

An increase in the release of endogenous insulin

A relative decrease in endogenous insulin production coupled with resistance to endogenous insulin

No change in or normal endogenous insulin levels

Correct answer: A complete absence of endogenous insulin production

Type 2 diabetics may experience several effects on or changes in endogenous insulin as a result of the disorder. Initially, patients may experience an increase in the release of endogenous insulin as a result of insulin resistance. As the disease progresses, endogenous insulin production gradually declines, causing a relative (versus absolute) lack of endogenous insulin. Endogenous insulin levels may remain normal, be lowered, or be higher than normal.

A complete absence of endogenous insulin production is a characteristic of type 1 diabetes.

34.

Cystic fibrosis results in impaired transport of which of the following? (Select 3.)

- **Sodium**
- **Chloride**
- **Water**
- Potassium
- Calcium

Cystic fibrosis affects the function of a transmembraneous protein called the cystic fibrosis transmembrane conductance regulator (CFTR). Malfunction of CFTR affects the transport of sodium, chloride, and water across epithelial tissues.

35.

Which of the following is the most common cause of cirrhosis in the United States?

Alcohol use

Chronic active hepatitis

Chronic right-sided congestive heart failure

Chronic biliary inflammation

Correct answer: Alcohol use

Cirrhosis is a serious and progressive disease that eventually results in hepatic failure. The most common cause of cirrhosis in the United States is alcohol use (Laennec's cirrhosis).

Other causes of cirrhosis include the following:

- *Chronic active hepatitis*
- *Chronic biliary inflammation or obstruction*
- *Chronic right-sided congestive heart failure*
- *Autoimmune hepatitis*
- *Hemochromatosis*
- *Wilson's disease*
- *Nonalcoholic steatohepatitis*
- *Cryptogenic cirrhosis*

36.

In an intubated patient undergoing general anesthesia, which of the following symptoms would most likely be seen in a patient experiencing massive pulmonary embolism?

Sudden hypotension

Bradycardia

Decreased pulmonary artery pressure

Decreased central venous pressure

Correct answer: Sudden hypotension

Pulmonary embolism is the blockage of a vessel or a network of vessels in the vasculature of the lungs. Signs of the condition in a patient under general anesthesia include:

- *Sudden hypotension*
- *Tachycardia, rather than bradycardia*
- *Significantly decreased end-tidal carbon dioxide*
- *Hypoxemia*
- *Bronchospasm*

Increased (rather than decreased) pulmonary artery pressure and central venous pressure may be seen in combination with a decrease in systolic and diastolic blood pressure.

37.

Which of the following medications should be avoided in a client who has asthma?

Meperidine

Ketamine

Halothane

Sevoflurane

Correct answer: Meperidine

The use of drugs often associated with histamine release should be avoided in patients with asthma, including curare, atracurium, mivacurium, morphine, and meperidine.

Ketamine is the only intravenous agent with bronchodilating properties and is a good choice for patients who are also hemodynamically unstable. Halothane and sevoflurane usually provide the smoothest inhalation induction with bronchodilation in asthmatic children.

38.

A 75-year-old post-surgical awake patient being cared for in the postanesthesia care unit (PACU) is demonstrating agitation. Which of the following medications commonly administered during surgery may cause an upper airway obstruction that manifests with symptoms of agitation?

Rocuronium

Sevoflurane

Propofol

Fentanyl

Correct answer: Rocuronium

One of the most common post-surgical complications during the immediate post-surgical period is upper airway obstruction. Patients may experience an upper airway obstruction as a result of loss of pharyngeal muscle tone, laryngospasm, previously undiagnosed obstructive sleep apnea, airway edema, or as the result of a residual neuromuscular blockade. Patients who receive one of the neuromuscular blockade agents (NMBAs), such as rocuronium, may experience only a partial reversal of the NMBA effects, even when a reversal agent such as neostigmine or edrophonium is administered. Often, the only symptom they exhibit is agitation. This is more common in elderly patients and should be closely watched for.

39.

In research, which of the following terms describes the variation of the sample mean for the collected data around the actual mean of the population?

Standard error of the mean

Standard deviation

Power

Variance

Correct answer: Standard error of the mean

The standard error of the mean describes the variation of the sample mean (for the actual data collected) around all possible observations (the true but unknown population mean).

Standard deviation is the positive square root of the variance. Power is the sensitivity of the planned experiment and analysis. Variance is the square of the sum of all of the deviations divided by the number of scores.

40.

All the following statements related to hypoglycemia are true except:

With hypoglycemia, there is a reflex catecholamine release that suppresses sympathetic activity

In anesthetized patients, signs of hypoglycemia may be misinterpreted as inadequate anesthesia

In patients being treated with beta-blockers, signs of hypoglycemia can be obscured

Diabetic patients who have chronically elevated blood glucose levels may be symptomatic at levels significantly above those of the normal, fasting patient

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Correct answer: With hypoglycemia, there is a reflex catecholamine release that suppresses sympathetic activity

With hypoglycemia, there is a reflex catecholamine release that produces overt sympathetic hyperactivity. This causes tachycardia, lacrimation, diaphoresis, and hypertension.

In anesthetized patients, signs of sympathetic hyperactivity can be easily misinterpreted as "light" or inadequate anesthesia. In patients being treated with beta-blockers or in patients with advanced diabetic autonomic neuropathy, signs of hypoglycemia can be obscured. The normal, fasting patient may have blood sugar levels lower than 50 mg/dL without any symptoms. However, diabetic patients who have chronically elevated blood glucose levels may be symptomatic at levels significantly above those of the normal, fasting patient.

41.

Which of the following statements about clonidine is true?

If added to lidocaine in a peripheral nerve block, it will markedly prolong the anesthetic effects

Abrupt discontinuation following long-term administration can lead to severe hypotension and sympathetic depression

It poorly penetrates the blood-brain barrier

It does not cross the placenta

Correct answer: If added to lidocaine in a peripheral nerve block, it will markedly prolong the anesthetic effects

When added to local anesthetics of intermediate duration (for example, mepivacaine or lidocaine) given for epidural or peripheral nerve block, clonidine will markedly prolong both the anesthetic and analgesic effects.

Abrupt discontinuation of clonidine following long-term administration can lead to withdrawal symptoms characterized by agitation, rebound hypertension, and sympathetic overactivity. Clonidine readily penetrates the blood-brain barrier and the placenta.

42.

What is the greatest risk associated with administering flumazenil to a patient who is receiving chronic benzodiazepine therapy?

Seizures

Hemolytic drug interactions

Inadequate sedation

Resedation

Correct answer: Seizures

Flumazenil is a benzodiazepine antagonist, increasing the risk of seizures occurring when the effects of chronic benzodiazepine use are suddenly reversed. Hemolytic drug interactions are not a concern when combining benzodiazepines and flumazenil. Reduced or absent sedation is the desired effect of flumazenil administration, not a risk associated with the medication. Resedation is a potential risk of flumazenil use due to the short duration of action relative to benzodiazepines. However, seizures are a more significant risk.

43.

Which of the following reversal agents is best for a patient who has received the neuromuscular blocking agent (NMBA) rocuronium as part of the anesthesia "cocktail" during their surgery?

Sugammadex

Neostigmine

Edrophonium

Glycopyrrolate

Correct answer: Sugammadex

Due to the risk of neuromuscular blockade in patients who have received one of the neuromuscular blocking agent (NMBA) drugs during surgery, reversal drugs must be co-administered. A partial, or incomplete, reversal of neuromuscular blockade may ultimately cause upper airway obstruction and respiratory depression, necessitating careful monitoring of patients in the PACU who have received an NMBA. Reversal agents such as neostigmine and edrophonium may be administered to patients who have received NMBAs. However, the reversal drug of choice for patients who have received rocuronium (or vecuronium) is sugammadex.

Sugammadex works by transporting the NMBA away from the neuromuscular junction, unlike the other reversal agents (such as neostigmine or edrophonium) in which the mechanism of action is that of an anticholinesterase. Glycopyrrolate is not a reversal agent but must be administered with the cholinergic reversal agents (neostigmine and edrophonium) to prevent the development of bradycardia or excessive oral secretion from the cholinergic drug.

44.

Which of the following are most important to evaluate after administering protamine? (Select 3.)

- **Blood pressure**
- **Activated clotting time**
- **Lung sounds**
- Platelet levels
- Skin turgor

Protamine can cause three different types of reactions. A type 1 reaction causes transient hypotension, making an evaluation of blood pressure following administration advisable. A type 3 reaction can cause a pulmonary hypertensive crisis, making an evaluation of lung sounds important. Activated clotting time should be performed to confirm the normalization of values. Protamine neutralizes heparin and heparin does not typically affect platelet levels except in rare cases of HIT. Skin turgor is not a relevant assessment following the administration of protamine.

45.

All the following statements are true about cerebral aneurysms except:

Most congenital cerebral aneurysms occur at the vertebrobasilar artery

Rupture of a saccular aneurysm is the most common cause of subarachnoid hemorrhage

A sudden, severe headache is the most typical complaint of a person presenting with an acute subarachnoid hemorrhage

Ruptured aneurysms usually present acutely as subarachnoid hemorrhage, while less commonly they hemorrhage into the epidural space or the brain

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Correct answer: Most congenital cerebral aneurysms occur at the vertebrobasilar artery

Cerebral aneurysms typically occur at the bifurcation of the large arteries at the base of the brain. The vast majority are located in the anterior Circle of Willis, not in the vertebrobasilar artery.

Subarachnoid Hemorrhage (SAH) occurs when blood enters into the space between the arachnoid membrane and the pia mater. It may be spontaneous with injury, but the most common cause is the rupture of a saccular aneurysm. Ruptured aneurysms usually present acutely as SAH, while less commonly they hemorrhage into the epidural space or the brain. Patients typically complain of a sudden, severe headache without focal neurological deficits. It is often associated with nausea and vomiting.

46.

All the following statements about cerebrospinal fluid are true except:

Small amounts of cerebrospinal fluid are absorbed into the bloodstream daily as compared to the amount required to surround and cushion the brain and spinal cord

Cerebrospinal fluid is produced predominantly in the choroid plexus

Approximately 500 mL of cerebrospinal fluid is produced daily

Normal pH of cerebrospinal fluid is between 7.28 and 7.32

Correct answer: Small amounts of cerebrospinal fluid are absorbed into the bloodstream daily as compared to the amount required to surround and cushion the brain and spinal cord

Cerebrospinal fluid (CSF) is produced primarily in the choroid plexus at a rate of about 500 mL per day. Only about 135 to 150 mL are required to cushion and surround the spinal cord and brain, thus rather large amounts of the fluid are absorbed into the bloodstream daily.

Normal pH of CSF ranges from 7.28 to 7.32.

47.

The most common cause of secondary hypertension in adults is which of the following?

Renal artery stenosis

Pregnancy

Obesity

Cigarette smoking

Correct answer: Renal artery stenosis

The most common cause of secondary hypertension is renal artery stenosis. Renal artery stenosis is a narrowing or blockage of the arteries that supply blood to the kidneys. Loss of blood flow to the kidneys increases cardiac output to compensate so it can maintain a minimal glomerular filtration rate. The increase in cardiac output cannot make up for the deficiency, resulting in chronic elevation of cardiac output through a stenotic renal artery.

Obesity, pregnancy, and unhealthy lifestyle habits such as cigarette smoking, are all risk factors for secondary hypertension, but the most common cause is renal artery stenosis.

48.

Which of the following medications may contribute to the development of hyperthyroidism?

Amiodarone

Amlodipine

Propylthiouracil

Propranolol

Correct answer: Amiodarone

Hyperthyroidism may result from several causes, including the administration of certain drugs, such as iodinated contrast dye or amiodarone. Other non-drug related causes include Graves disease, toxic multinodular goiter, thyroiditis, cancer of the thyroid, tumors of the pituitary gland, struma ovarii, and disorders specific to pregnancy.

Both propranolol and propylthiouracil are used in the treatment of hyperthyroidism.

The use of amlodipine does not cause hyperthyroidism.

49.

The treatment of hypercalcemia includes all the following except:

Brisk diuresis with a loop diuretic followed by rehydration with saline

Rehydration with saline followed by furosemide

Following rehydration and diuresis, treatment with bisphosphonates or calcitonin if needed

Glucocorticoids in the presence of vitamin D-induced hypercalcemia

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Correct answer: Brisk diuresis with a loop diuretic followed by rehydration with saline

Premature diuretic therapy before rehydration can aggravate hypercalcemia because of additional volume depletion. The most effective initial treatment is rehydration followed by a brisk diuresis with the administration of an intravenous saline infusion and a loop diuretic to accelerate calcium excretion.

Although hydration and diuresis may remove the potential risk of cardiovascular and neurological complications of hypercalcemia, the serum calcium usually remains elevated above normal. Additional therapy with a bisphosphonate or calcitonin may be required to further lower the serum calcium. Additional treatment depends on the underlying cause and may include glucocorticoids in the presence of vitamin D-induced hypercalcemia, such as granulomatous disease states.

50.

Which of the following statements about innervation of the heart is true?

Parasympathetic fibers are primarily responsible for innervation of the atria.

Innervation of the sinoatrial node comes via the left vagus afferent fibers.

Acetylcholine acts on specific cardiac receptors to produce positive inotropic effects.

Parasympathetic fibers are widely distributed throughout the heart.

Correct answer: Parasympathetic fibers are primarily responsible for innervation of the atria.

Parasympathetic fibers primarily innervate the atria and conducting tissues of the heart.

The innervation of the sinoatrial node comes via the right vagus efferent fibers (the parasympathetic nervous system). The left sympathetic (afferent) and vagus nerves primarily affect the atrioventricular node. Norepinephrine release (rather than the action of acetylcholine) produces positive inotropic effects. Acetylcholine causes negative chronotropic, dromotropic, and inotropic effects. Sympathetic fibers, rather than parasympathetic fibers, are more widely distributed throughout the heart.

51.

What effect is lithium most likely to have on the minimum alveolar concentration (MAC)?

Decreased MAC

Increased MAC

No effect on MAC

Unpredictable effect on MAC

Correct answer: Decreased MAC

Lithium is an example of a nonanesthetic medication that can result in a lowered minimum alveolar concentration (MAC). Lithium is not likely to increase MAC or have no effect on MAC. The effect of lithium on MAC is predictable.

52.

A patient who is being asked to consent to the use of blood products asks about the risk of liver infections. Knowledge of which fact should guide the CRNA's answer?

There is about a 1 in a million risk of getting hepatitis from a blood transfusion

There is about a 1 in 100 million risk of getting hepatitis from a blood transfusion

There is about a 1 in 10,000 risk of getting hepatitis from a blood transfusion

There used to be a risk of getting hepatitis from a blood transfusion but this risk is no longer present

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Correct answer: There is about a 1 in a million risk of getting hepatitis from a blood transfusion

The risk of developing hepatitis that is transmitted by blood transfusion is about 1 in a million. While modern blood collection practices have significantly reduced this risk, the risk is still present, albeit minimal.

53.

Which of the following types of receptors bind to acetylcholine?

Nicotinic and muscarinic

Cholinergic and adrenergic

Muscarinic and adrenergic

Adrenergic and nicotinic

Correct answer: Nicotinic and muscarinic

Acetylcholine is released by cholinergic neurons and norepinephrine is released by adrenergic neurons. There are two types of cholinergic receptors, nicotinic and muscarinic, both of which bind to acetylcholine.

54.

Which of the following conditions is most likely to cause a vitamin K deficiency?

Fat malabsorption

Bleeding disorder

Liver disease

Hypokalemia

Correct answer: Fat malabsorption

Fat malabsorption can affect vitamin K levels, as vitamin K is a fat-soluble vitamin. Vitamin K deficiency can cause bleeding disorders, not the other way around. Liver disease and hypokalemia do not have a significant effect on vitamin K levels.

55.

Which of the following conditions is a contraindication to the use of metoclopramide?

Parkinson's disease

Severe nausea

Intractable depression

Crohn's disease

Correct answer: Parkinson's disease

Metoclopramide causes a mild dopamine receptor-blocking effect, potentially exacerbating the symptoms of Parkinson's disease. For this reason, metoclopramide is generally contraindicated in patients with Parkinson's disease. Metoclopramide is also contraindicated with intestinal obstruction. Severe nausea, intractable depression, and Crohn's disease are not contraindications to using metoclopramide.

56.

Which of the following statements is true about myasthenia gravis?

Episodes of frequent vomiting may lead to an exacerbation of symptoms.

It primarily affects smooth, involuntary muscles.

A patient with myasthenia gravis should never receive succinylcholine to facilitate endotracheal intubation.

The antibiotic of choice to treat upper respiratory tract infections in myasthenia gravis patients is levofloxacin.

Correct answer: Episodes of frequent vomiting may lead to an exacerbation of symptoms.

Hypokalemia (low levels of potassium in the blood) caused by diuretics or frequent vomiting can exacerbate Myasthenia Gravis (MG) symptoms. Other reasons for exacerbations of MG symptoms include the following:

- *Emotional stress*
- *Exposure to extreme temperatures*
- *Fever*
- *Illness (respiratory infection, pneumonia, tooth abscess)*
- *Some medications (muscle relaxants, anticonvulsants, and certain antibiotics)*

MG affects voluntary (not involuntary) muscles, such as the ocular and pharyngeal muscles. Succinylcholine can be used to facilitate endotracheal intubation; however, the results are variable. Resistance to succinylcholine may be present, and the effects of succinylcholine can be prolonged. The fluoroquinolones, such as levofloxacin and ciprofloxacin, have been associated with the worsening of symptoms of MG and carry a black box warning issued by the United States Food and Drug Administration.

57.

All the following induction drugs reduce cerebral metabolic rate except:

Ketamine

Propofol

Thiopental

Midazolam

Correct answer: Ketamine

Ketamine is likely to have no effect on (or may slightly increase) cerebral metabolic rate.

All other anesthetic agents (including propofol, thiopental, and midazolam) cause cerebrovascular constriction.

58.

Which of the following is likely to be increased when nitroglycerin is administered? (Select 2.)

Cerebral blood flow

Intracranial pressure

Mean arterial pressure

Systolic blood pressure

Temperature

Nitroglycerin leads to the dilation of intracranial blood vessels, increasing cerebral blood flow and intracranial pressure. Systemic vasodilatation decreases mean arterial pressure and systolic blood pressure. Temperature is not typically meaningfully affected by nitroglycerin administration.

59.

Which of the following drugs, if administered during a cholangiogram, can result in a false-positive result?

Morphine

Glucagon

Halothane

Naloxone

Correct answer: Morphine

All opioids can potentially cause spasm of the Sphincter of Oddi and increase biliary pressure. The use of intravenous opioids (such as morphine, fentanyl, meperidine, butorphanol, and nalbuphine) can induce biliary colic or result in false-positive cholangiograms.

Halothane, naloxone, and glucagon are reported to relieve opioid-induced biliary spasms.

60.

Which of the following is an important goal for the anesthetist in managing a patient with mitral stenosis?

In relation to preload, maintain euvolemia to slight overload in fluid volume and maintain normal sinus rhythm on the lower side of normal. For afterload, maximize systemic vascular resistance.

In relation to preload, slightly decrease fluid volume and maintain normal sinus rhythm on the higher side of normal. For afterload, maximize systemic vascular resistance.

In relation to preload, maintain euvolemia to slight overload in fluid volume and maintain normal sinus rhythm on the higher side of normal. For afterload, lower systemic vascular resistance.

In relation to preload, slightly decrease fluid volume and maintain normal sinus rhythm on the lower side of normal. For afterload, lower systemic vascular resistance.

Correct answer: In relation to preload, maintain euvolemia to slight overload in fluid volume and maintain normal sinus rhythm on the lower side of normal. For afterload, maximize systemic vascular resistance.

The primary goals in the anesthetic management of mitral stenosis are to maintain a sinus rhythm (if present preoperatively) and to avoid tachycardia (large increases in cardiac output) and hypovolemia. These can best be met by administering adequate IV fluid volumes, avoiding significant heart rate increases to compensate for reduced stroke volume, and maximizing the effectiveness of each cardiac contraction while avoiding significant increases in heart rate.

61.

Primary acute aortic insufficiency most often occurs as a result of which of the following?

Infective endocarditis

History of rheumatic valvular disease

Trauma

Aneurysm

Correct answer: Infective endocarditis

Aortic insufficiency, or aortic regurgitation, may be acute or chronic and can result from primary or secondary causes. Aortic insufficiency, which can be primary or acute, typically results from infective endocarditis.

Rheumatic valvular disease is a cause of primary chronic aortic insufficiency. Both trauma and aneurysm may cause acute secondary aortic insufficiency.

62.

An infant with persistent vomiting associated with hypertrophic pyloric stenosis is most likely to develop which of the following conditions?

Hypochloremic metabolic alkalosis

Hypochloremic metabolic acidosis

Hyperchloremic metabolic alkalosis

Hyperchloremic metabolic acidosis

Correct answer: Hypochloremic metabolic alkalosis

Hypertrophic pyloric stenosis interferes with the emptying of stomach contents. Persistent vomiting depletes sodium, potassium, chloride, and hydrogen ions, leading to hypochloremic metabolic alkalosis.

63.

A 50-year-old female arrives at the emergency department following a motor vehicle accident. Her eyes open when you enter the room. She is moaning, and when she attempts to answer a question, her speech is incomprehensible. She is unable to follow commands, but she withdraws her arms to painful stimuli.

What is this patient's score on the Glasgow Coma Scale?

10

12

8

9

Correct answer: 10

Using the Glasgow Coma Scale, this patient scores 4 points for spontaneous eye-opening, 4 points for withdrawing from pain, and 2 points for incomprehensible sounds.

The Glasgow Coma Scale uses the following rating system:

Eye opening:

- *Spontaneous: 4 points*
- *To speech: 3 points*
- *To pain: 2 points*
- *Nil: 1 point*

Motor response:

- *Obeys verbal commands: 6 points*

Motor response to pain:

- *Localizes: 5 points*
- *Withdraws: 4 points*
- *Decorticate posture: 3 points*
- *Extensor response: 2 points*
- *Nil: 1 point*

Verbal response:

- *Oriented: 5 points*
- *Confused conversation: 4 points*
- *Inappropriate speech: 3 points*
- *Incomprehensible sounds: 2 points*
- *Nil: 1 point*

64.

During a classic allergic asthma attack, which of the following are released?

Histamine and leukotrienes

Acetylcholine and secretin

Bradykinin and secretin

Leukotrienes and serotonin

Correct answer: Histamine and leukotrienes

In classic allergic asthma, bronchoconstriction is the result of the release of the following:

- *Histamine*
- *Bradykinin*
- *Leukotrienes C, D, and E*
- *Platelet-activating factor*
- *Prostaglandins*
- *Neutrophil and eosinophil chemotactic factors*

The role of serotonin in classic allergic asthma in humans is unknown. Secretin is a hormone that regulates the balance and homeostasis of water in the body and is not involved in the typical asthma response.

65.

Carcinoid tumors most commonly develop in which of the following?

Gastrointestinal (GI) tract

Pancreas

Lung

Adrenal gland

Correct answer: Gastrointestinal (GI) tract

Carcinoid tumors, comprised of enterochromaffin cells, most commonly develop in the GI tract. Their primary sites of origin within the GI tract include the appendix, jejunoileum, rectum, and duodenum. Other sites where carcinoid tumors may be found include the pancreas, the lungs, the thymus, and the liver. When these tumors are identified within other, non-GI locations, they are typically referred to as neuroendocrine tumors.

66.

Which of the following statements is true about hypertrophic cardiomyopathy?

It is characterized by excessive overgrowth of the heart muscle, especially of the intraventricular septum near the aortic valve.

It is characterized by fluid volume overload.

Affected patients display systolic dysfunction.

Supraventricular arrhythmias are rarely associated with the condition.

Correct answer: It is characterized by excessive overgrowth of the heart muscle, especially of the intraventricular septum near the aortic valve.

Hypertrophic cardiomyopathy (HCM) is the most common genetic cardiovascular disease. It is characterized by left ventricular hypertrophy, especially in the upper intraventricular septum near the aortic valve.

Because of hypertrophy, the walls of the heart stiffen, the mitral and aortic valve functions are impaired, and normal blood flow from the heart is restricted. The condition is not characterized by fluid volume overload. HCM patients display diastolic dysfunction (rather than systolic), which is reflected by increased left ventricular end-diastolic pressures. Both ventricular and supraventricular arrhythmias are common in patients with HCM.

67.

Autoregulation of renal blood flow normally occurs between which of the following mean arterial pressures?

80 and 180 mmHg

60 and 110 mmHg

70 and 130 mmHg

100 and 200 mmHg

Correct answer: 80 and 180 mmHg

Autoregulation of renal blood flow normally occurs between mean arterial pressures of 80 and 180 mmHg.

Regulation of Renal Blood Flow (RBF) represents a complex interplay between intrinsic autoregulation, tubuloglomerular balance, and hormonal and neuronal influences. Blood flow is generally decreased at mean arterial pressures less than 70 mmHg. Outside the autoregulation limits, RBF becomes pressure-dependent. Glomerular filtration generally ceases when mean systemic arterial pressure is less than 40-50 mmHg.

68.

Which of the following statements is true about blood flow and coronary artery perfusion?

Normal coronary artery blood flow is approximately 250 mL per minute

The right ventricle is perfused almost entirely during diastole

The left ventricle is perfused during both systole and diastole

Coronary perfusion is continuous

Correct answer: Normal coronary artery blood flow is approximately 250 mL per minute

Normally, coronary artery blood flow is approximately 250 mL per minute; however, due to the contraction of the four chambers of the heart and the pressure generated, blood flow is interrupted with every contraction, so coronary perfusion is intermittent, not continuous.

The left ventricle, rather than the right, is perfused almost entirely during diastole. The right ventricle is perfused during both systole and diastole.

69.

A patient has a stroke volume of 60 mL, a heart rate of 70, a mean pulmonary artery pressure of 30 mmHg, and a central venous pressure of 20. Which of the following represents this patient's cardiac output value in liters per minute?

4.2

1.8

1.4

2.1

Correct answer: 4.2

To calculate cardiac output, stroke volume is multiplied by heart rate: (SV x HR = CO) 60 x 70 = 42 mL or 4.2 liters per minute.

Mean pulmonary artery pressure and central venous pressure are not part of the calculation of cardiac output.

70.

A Caucasian 29-year-old female patient presenting with remitting and exacerbating gastrointestinal (GI) symptoms of diarrhea, abdominal pain, and passing of blood in her stools has been found to have inflammation of the mucosa throughout her colon and rectum.

The most likely diagnosis for this patient is which of the following?

Ulcerative colitis

Crohn's disease

Irritable bowel syndrome

Colon cancer

Correct answer: Ulcerative colitis

Both ulcerative colitis and Crohn's disease are considered to be inflammatory bowel diseases, and they often present with similar symptoms of abdominal pain, diarrhea, and the passing of blood in stools. Patients suffering from Crohn's disease may also present with symptoms of protein and mineral deficiencies. Ulcerative colitis most commonly affects Caucasian females between the ages of 20 and 40 and causes inflammatory lesions of the colonic mucosa versus affecting deeper layers of the intestinal tissue or causing abscesses or granulomatous disease, as is common in Crohn's disease.

Irritable bowel syndrome may also present with symptoms of abdominal pain and diarrhea but does not typically cause blood to be passed in stools.

A work-up for colon cancer often identifies narrowing of the intestinal lumen due to thickening of the tissues, masses within the colon (which may be ulcerated), and enlarged lymph nodes within the adjacent intestinal region, as well as symptoms of abdominal pain, diarrhea, or the passage of blood in the stools.

71.

Which of the following is correct regarding the bronchodilating effects of volatile anesthetics?

Volatile anesthetics that are bronchodilators have agent-specific differences

Not all volatile anesthetics are bronchodilators

Volatile anesthetics that are bronchodilators all have a similar bronchodilating effect

Volatile anesthetics all have bronchodilating effects, but only when combined with other medications

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Correct answer: Volatile anesthetics that are bronchodilators have agent-specific differences

All volatile anesthetics are bronchodilators. However, they do have agent-specific differences. Volatile anesthetics do not all have a similar effect and are bronchodilators on their own.

72.

Minimal alveolar concentration is decreased approximately how much per decade of age, regardless of volatile anesthetic?

6 percent

10 percent

3 percent

15 percent

Correct answer: 6 percent

Minimal alveolar concentration (MAC) can be altered by several physiological and pharmacological variables. One of the most striking is the six percent decrease in MAC per decade of age, regardless of volatile anesthetic.

73.

Which of the following statements is true about acid-base balance?

Plasma potassium increases with worsening acidosis

Progressive hypokalemia occurs as a result of the movement of potassium out of the cells in exchange for extracellular hydrogen in acidosis

Progressive hyperkalemia occurs as a result of the movement of potassium out of the cells in exchange for extracellular hydrogen in alkalosis

Central nervous system depression is more prominent with metabolic acidosis than with respiratory acidosis

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Correct answer: Plasma potassium increases with worsening acidosis

Plasma potassium levels increase approximately 0.6 mEq/L for each 0.10 decrease in pH.

Progressive hyperkalemia results from the movement of potassium out of the cells in exchange for extracellular hydrogen in acidosis. Central nervous system depression is more prominent with respiratory acidosis than metabolic acidosis. This effect is often called CO2 narcosis and may be due to intracranial hypertension secondary to increased cerebral blood flow and severe intracellular acidosis.

74.

Which of the following thrombolytics is a non-fibrin-specific agent?

Streptokinase

Alteplase

Reteplase

Tenecteplase

Correct answer: Streptokinase

All answers are examples of thrombolytic. However, only streptokinase is a non-fibrin-specific agent. Alteplase, reteplase, and tenecteplase are all fibrin-specific agents.

75.

Which of the following are the common causes of hypothyroidism? (Select 2.)

Autoimmune disease

Iodine deficiency

Parathyroidectomy

Thyrotoxicosis

Neck injury

Hypothyroidism is most commonly caused by either iodine deficiency or Hashimoto's disease, an autoimmune condition. A parathyroidectomy is unlikely to significantly affect the thyroid, although a thyroidectomy carries a much greater risk of affecting the parathyroid glands. Thyrotoxicosis occurs due to hyperthyroidism. Neck injuries may cause hypothyroidism, but they are not a common cause of this condition.

76.

Which of the following antidysrhythmics may prolong paralysis when cholinesterase inhibitors are used? (Select 2.)

Quinidine

Procainamide

Lidocaine

Flecainide

Sotalol

Quinidine and procainamide are both class 1a antidysrhythmics and can prolong paralysis caused by the use of cholinesterase inhibitors. Lidocaine, flecainide, and sotalol are unlikely to significantly prolong paralysis.

77.

Which of the following statements is true related to the treatment of pulseless electrical activity (PEA), according to Advanced Cardiac Life Support guidelines and protocols?

Epinephrine 1 mg may be given via IV/IO route every 3 to 5 minutes

Atropine is one of the drugs recommended for the treatment of PEA

40 units of vasopressin can be given IV to replace the first or second dose of epinephrine

Defibrillation at 300 joules has been shown to increase the survival rate of PEA

Correct answer: Epinephrine 1 mg may be given via IV/IO route every 3 to 5 minutes

Epinephrine 1 mg may be given via IV/IO route every 3 to 5 minutes when treating PEA and is currently the only drug recommended for resuscitation during a pulseless arrest.

According to the Advanced Cardiac Life Support guidelines and protocols, neither atropine nor vasopressin is recommended any longer for the treatment of PEA, and this rhythm does not respond to defibrillation, making it an ineffective treatment.

78.

The most common cause of primary hypothyroidism in adults is which of the following?

Hashimoto thyroiditis

Graves disease

Radioactive iodine treatment

Surgical treatment for hyperthyroidism

Correct answer: Hashimoto thyroiditis

Hypothyroidism may result from congenital causes (cretinism), an iatrogenic cause (such as surgery or radioactive iodine treatment to treat hyperthyroidism), or it may be acquired. Hashimoto thyroiditis, an autoimmune disorder, is the most common cause of (primary) acquired hypothyroidism in adults. Secondary causes of hypothyroidism include pituitary disorders, which result in insufficient TSH production.

Graves disease causes hyperthyroidism.

79.

Which of the following is the target site for antidiuretic hormone?

Collecting tubules of the kidney

The hypothalamus

The posterior pituitary

Glomerulus of the kidney

Correct answer: Collecting tubules of the kidney

The goal of antidiuretic hormone (ADH) is to prevent water loss, thereby decreasing serum osmolality and increasing the circulating volume. To accomplish this, ADH targets the collecting tubules of the kidneys, rather than the glomerulus of the kidney.

ADH is produced in the hypothalamus and is stored in and secreted by the posterior pituitary gland.

80.

A type 2 diabetic is scheduled to undergo surgery. They take the oral glucose-lowering agent, metformin, as part of their medication treatment for diabetes. Current recommendations on the use of biguanides for diabetics preparing to undergo surgery include all the following except:

Metformin must be discontinued 48 hours prior to surgery to prevent the risk of the development of (potentially fatal) lactic acidosis

Metformin may be continued as ordered in diabetic patients preparing to undergo surgery despite the risk of (potentially fatal) lactic acidosis

Metformin may be held the morning of surgery and then administered perioperatively in diabetic patients without any increased risk of (potentially fatal) lactic acidosis

Metformin may be administered to diabetic patients preparing to undergo surgery because there is no proven increased risk of developing lactic acidosis during surgery

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Correct answer: Metformin must be discontinued 48 hours prior to surgery to prevent the risk of (potentially fatal) lactic acidosis

Currently, the biguanide class of oral glucose-lowering agents contains only one drug available in most countries, metformin. Metformin is preferred as a first-line oral glucose-lowering agent and is often available in combination with other oral glucose-lowering drugs in a single-tablet format. Anecdotal individual case reports of fatal lactic acidosis in diabetic surgical patients taking biguanides led to the blanket recommendation that biguanides be discontinued 48 hours prior to surgery. A recent Cochrane Database review of the use of biguanide drugs in diabetic surgical patients has not revealed any evidence showing an increased risk of developing lactic acidosis when compared to patients not taking biguanides.

Current recommendations on the administration of biguanide drugs to diabetic surgical patients state that metformin may be continued in these patients despite the anecdotal, individual case reports of risk of lactic acidosis and that metformin may be administered perioperatively (close to the time of surgery) without any evidence showing an increased risk of lactic acidosis.

81.

Which of the following are the signs and symptoms of Cushing's triad?

Bradycardia, hypertension, irregular respirations

Hypotension, bradycardia, irregular respirations

Hypertension, tachycardia, irregular respirations

Hypotension, tachycardia, irregular respirations

Correct answer: Bradycardia, hypertension, irregular respirations

Increased intracranial pressure cuts blood flow off, so blood pressure increases to restore blood flow through the vessels. The increased blood pressure causes reciprocal bradycardia, and irregular respirations occur due to pressure on the medulla oblongata.

82.

Peripheral chemoreceptors in the carotid bodies are sensitive to changes in all the following except:

blood pressure

pH

partial pressure of carbon dioxide in arterial blood (PaCO2)

partial pressure of oxygen in arterial blood (PaO2)

Correct answer: blood pressure

Baroreceptors, rather than chemoreceptors, monitor and respond to changes in blood pressure.

Peripheral chemoreceptors include the carotid bodies and the aortic bodies. The carotid bodies are the primary peripheral chemoreceptors in humans and are sensitive to changes in the following:

- *Partial pressure of oxygen in arterial blood (PaO2)*
- *Partial pressure of carbon dioxide in arterial blood (PaCO2)*
- *pH*
- *Arterial perfusion pressure*

83.

A patient with rheumatoid arthritis is taking methotrexate as part of her routine medication regimen. Related to methotrexate, which of the following preoperative tests are most important prior to administration of general anesthesia?

Kidney function tests and a complete blood count

Serum sodium level and pulmonary function tests

Electrocardiogram and serum sodium level

Complete blood count and electrocardiogram

Correct answer: Kidney function tests and a complete blood count

Kidney function tests, a complete blood count, and liver function tests are needed in a patient who is taking methotrexate because it can potentially cause the following:

- *Kidney problems*
- *Hepatotoxicity*
- *Anemia*
- *Leukopenia*

Studies such as pulmonary function tests, electrolyte studies, and an electrocardiogram are not specifically related to the use of methotrexate.

84.

A 10-year-old boy who was involved in a high-speed motor vehicle accident is in critical condition with head injuries and multiple extremity fractures. He was admitted to the pediatric intensive care unit (PICU) three days ago. He has been kept sedated by the use of a propofol infusion, is receiving vasopressor support due to extreme blood loss, and is also receiving intravenous antibiotics and round-the-clock administration of narcotic pain medication. On day 3 of his PICU admission, he became febrile and exhibited signs of cardiac failure. Laboratory studies and a physical examination revealed the following findings: severe lactic acidosis, hepatomegaly, hypertriglyceridemia, and rhabdomyolysis.

The patient in this scenario is most likely experiencing symptoms as a result of which of the following?

Propofol infusion

Sepsis

Increased intracranial pressure due to his head injuries

Fat embolism

Correct answer: Propofol infusion

Propofol infusion syndrome has been reported to occur in critically ill patients who are being kept sedated by the use of a continuous propofol infusion. While the syndrome has occurred in adult patients, it occurs far more often in children whose sedation has been maintained by propofol for longer than 48 hours and at a dose greater than 4 mg/kg/hr. (It may also occur with lower dosing.) Propofol infusion syndrome is characterized by the development of heart failure, hepatomegaly, severe lactic acidosis, hypertriglyceridemia, rhabdomyolysis, fever, and cardiac arrhythmias, and results in death as much as 80% of the time. Because propofol infusion syndrome occurs as a result of impairment of mitochondrial function, children with known mitochondrial disorders are at increased risk of the syndrome with propofol administration.

Signs of sepsis include a decrease in urine output, hyperthermia or hypothermia, tachycardia, petechiae, disseminated intravascular coagulation (DIC), and systemic collapse. Signs of increased intracranial pressure (ICP) include headache, nausea and vomiting, increased blood pressure, and unresponsive pupils. Signs of fat embolism include tachypnea and shortness of breath, confusion, lethargy, loss of consciousness, fever, and petechial rash.

85.

In the research process, which of the following steps is completed after analysis and interpretation of the data?

Dissemination of the findings to interested colleagues

Formulation of the hypothesis

Review of the relevant knowledge and literature

Execution of the research plan

Correct answer: Dissemination of the findings to interested colleagues

Following the analysis and interpretation of the data, the findings are disseminated to interested colleagues.

Before the data can be meaningfully analyzed and interpreted, the research process takes these steps:

1. *Identification of the problem*
2. *Review of relevant knowledge and literature*
3. *Formulation of the hypothesis*
4. *Development of an approach for testing the hypothesis*
5. *Execution of the research plan*

86.

Which of the following are bloodborne pathogens? (Select 3.)

- **HIV**
- **Hepatitis B**
- **Hepatitis C**
- Hepatitis A
- Scarlet fever (Streptococcus pyogenes)

HIV, hepatitis B, and hepatitis C are all bloodborne pathogens. Hepatitis A is not considered a bloodborne pathogen. Streptococcus pyogenes is also not a bloodborne pathogen.

87.

An asthmatic patient who is being treated with an inhaled short-acting beta2-agonist has continued to experience nighttime waking 2 to 3 times per week due to asthma symptoms. As the appropriate next step in asthma management, the practitioner should prescribe which of the following drugs?

A low-dose (up to 400 micrograms/day) inhaled corticosteroid (ICS)

A long-acting beta2-agonist

A medium-dose (up to 800 micrograms/day) inhaled corticosteroid (ICS)

An oral steroid

Correct answer: A low-dose (up to 400 micrograms/day) inhaled corticosteroid (ICS)

Asthma treatment should be managed using a step-wise approach based on the classification and severity of asthma symptoms. Initial treatment with a short-acting beta2-agonist, such as salbutamol, should be followed by the (preferred) addition of a low-dose Inhaled CorticoSteroid (ICS) if asthma symptoms do not abate. An alternative is the addition of agents such as cromolyn or theophylline.

A long-acting beta2-agonist should be combined with a low-dose ICS or a medium-dose inhaled corticosteroid should symptoms persist or severity not improve. An oral steroid should not be introduced until step 6 after other, more conservative medication treatment options have failed.

88.

All the following are endogenous peptides that bind to opioid receptors except:

Bradykinin

Enkephalin

Endorphin

Dynorphin

Correct answer: Bradykinin

Bradykinin is a powerful vasodilator, an endogenous peptide that does not bind to opioid receptors. The actions of bradykinin are similar to histamine.

Dynorphin, endorphin, and enkephalin are endogenous peptides that do bind to opioid receptors. Opiate-receptor activation inhibits the presynaptic release and postsynaptic response to excitatory neurotransmitters (for example, acetylcholine and substance P) from nociceptive neurons.

89.

Which of the following effects should the nurse anesthetist expect cerebral palsy to have on minimum alveolar concentration (MAC)?

Reduced MAC

Increased MAC

No change in MAC

Variable effects on MAC depending upon other comorbidities

Correct answer: Reduced MAC

Cerebral palsy can reduce MAC by up to 25%. It will not generally increase MAC or cause no change in MAC. While other comorbidities can also affect MAC, cerebral palsy will always result in a reduced MAC.

90.

A patient with rheumatoid arthritis (RA) may experience all the following complications as a result of arthritis of the cricoarytenoid joint *except*:

Limited jaw motion

Dyspnea

Misdiagnosis of sleep apnea

Inspiratory stridor

Correct answer: Limited jaw motion

Rheumatoid arthritis (RA) is a chronic inflammatory disorder likely caused by a complex combination of factors, including genetics and a host of interconnected factors, such as viral or bacterial exposure or infection, as well as hormones. RA typically affects the joints initially but, over time, also impacts the body systemically, including the cardiovascular system, the lungs, the skin structures, the eyes, and the oral cavity.

In severe disease, the cricoarytenoid joint is often affected, resulting in complications such as dyspnea, snoring often misdiagnosed as sleep apnea, inspiratory stridor on examination, a hoarse-sounding voice, and pain when swallowing.

Limitations in jaw motion result from RA involvement of the temporomandibular joint.

91.

As a general rule, when should oral preoperative medications be administered?

60 to 90 minutes before the patient goes to the operating room

When the patient arrives in the operating room

20 minutes before the patient goes to the operating room

Four hours before the patient goes to the operating room

Correct answer: 60 to 90 minutes before the patient goes to the operating room

Administering preoperative oral medications 60 to 90 minutes before going to the operating room gives the medication time to work before surgery begins.

Medications given only 20 minutes before going to the operating room or when the patient arrives will not have time to work. Medications given four hours prior to surgery may begin to lose some of their effectiveness.

92.

For which of the following would nitric oxide be most likely to be utilized?

Reduce blood pressure in uncontrolled hypertension

Increase the speed of anesthesia induction with sevoflurane

Slow the speed of anesthesia induction with sevoflurane

Provide anesthesia during dental procedures

Correct answer: Reduce blood pressure in uncontrolled hypertension

Nitric oxide is a vasodilator and is used to treat hypertension. Nitrous oxide, not nitric oxide, is an inhalation anesthetic that can increase the speed of anesthesia induction with sevoflurane or provide anesthesia during dental procedures.

93.

Which of the following can be part of first-line therapy for neuropathic pain? (Select 2.)

Antiepileptic gabapentinoids

Tricyclic antidepressants

Topical lidocaine

Topical capsaicin

Tramadol

Antiepileptic gabapentinoids and tricyclic antidepressants are both first-line therapies for neuropathic pain. Topical lidocaine and topical capsaicin are both second-line therapies for neuropathic pain. Tramadol is further down the line but is a potential treatment for neuropathic pain.

94.

Contact dermatitis is an example of which of the following types of hypersensitivity reaction?

Type IV

Type I

Type II

Type III

Correct answer: Type IV

Type IV hypersensitivity reactions are characterized by interactions of sensitized cytotoxic T-cells with specific antigens, or delayed sensitivity reactions. Delayed sensitivity reactions usually disappear in 72 to 96 hours.

Anaphylaxis is an example of a Type I hypersensitivity reaction. ABO incompatibility is an example of a Type II hypersensitivity reaction. Rheumatoid arthritis is an example of a Type III hypersensitivity reaction.

95.

In a female patient, Crohn's disease may occur in all the following anatomical sites except:

The ovaries

The mouth

The anus

The esophagus

Correct answer: The ovaries

Crohn's disease affects both females and males and may affect any portion of the gastrointestinal (GI) tract, from the mouth to the anus. Most frequently, Crohn's disease affects the distal ileum and the proximal portion of the large intestine. In females, Crohn's disease may contribute to the formation of abscesses or fistulas that open within the pelvis or vulvar regions. While intestinal manifestations of Crohn's disease may be misdiagnosed as being ovarian in origin, Crohn's disease does not directly occur in the ovaries.

96.

Which of the following conditions would latanoprost be used to treat?

Glaucoma

Cataracts

Retinal detachment

Macular degeneration

Correct answer: Glaucoma

Latanoprost is a prostaglandin that promotes the uveoscleral outflow of aqueous humor, decreasing intraocular pressure. Latanoprost is not used as a primary treatment for cataracts, retinal detachment, or macular degeneration.

97.

Arteriovenous (AV) malformations are most likely to be found in which of the following patient populations?

Patients with cerebral aneurysms

Patients with increased intracranial pressure (ICP)

Patients with gliomas or other intracranial masses

Patients with seizure disorders

Correct answer: Patients with cerebral aneurysms

Ten percent of patients who have a cerebral aneurysm are also diagnosed with an arteriovenous (AV) malformation. AV malformations are congenital in nature and characteristically are comprised of a tangled network of intracerebral arteries that feed directly into veins. Hemorrhage may result from AV malformation, depending upon the overall size of the malformation, as well as the specific characteristics of the arteries contained within the tangle. Blood flow at the site of the AV malformation is impaired, as the malformation does not possess the ability to effectively regulate blood flow.

98.

Which of the following is the primary effect of phosphodiesterase inhibitors?

Smooth muscle relaxation

Decreased afterload

Dilation of airways

Improved renal function

Correct answer: Smooth muscle relaxation

Phosphodiesterase inhibitors primarily cause smooth muscle relaxation. This can lead to vasodilatation that decreases afterload or to dilation of airways. Improved renal function is not typically an effect of phosphodiesterase inhibitors.

99.

Normally, healthy adults secrete approximately 20 mg of cortisol per day. During periods of extreme stress, this amount may be increased to up to how many mg of cortisol per day?

300 mg

100 mg

60 mg

500 mg

Correct answer: 300 mg

Cortisol is the most potent endogenous glucocorticoid. Daily production is about 20 mg and maximal output is 150 to 300 mg per day.