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Question: 1121

A 4-year-old child (17 kg) is being monitored intraoperatively with a pulse oximeter during a 4-hour reconstructive craniofacial surgery. Approximately 90 minutes into surgery, the anesthesiologist notes the plethysmographic waveform on the pulse oximeter becomes dampened and the displayed SpO_2 reads 99%. A simultaneous arterial blood gas shows PaO_2 of 210 mmHg and a measured SaO_2 of 85% on co-oximetry. Total hemoglobin is 9.2 g/dL. Which of the following most likely accounts for the discrepancy between SpO_2 and co-oximetry SaO_2?

A. Elevated levels of methemoglobin or another dyshemoglobin are causing the pulse oximeter to falsely display SpO_2 near 85% trending toward 85%, and co-oximetry is more accurate

B. The pulse oximeter is displaying an erroneously high SpO_2 due to the presence of significant methemoglobinemia, while co-oximetry is accurately reflecting true oxyhemoglobin saturation

C. Methemoglobinemia is causing co-oximetry to underestimate oxyhemoglobin, while pulse oximetry reads 99% accurately

Answer: B

Explanation: Standard pulse oximetry uses only two wavelengths of light (660 nm red and 940 nm near-infrared) to calculate a ratio (R) from which SpO_2 is derived. It fundamentally assumes that only two species of hemoglobin are present: oxyhemoglobin (HbO_2) and deoxyhemoglobin (Hb). When dyshemoglobins such as methemoglobin (MetHb) are present, the pulse oximeter is fooled because MetHb absorbs nearly equally at both 660 nm and 940 nm wavelengths, producing an R value approaching 1.0, which the device interprets as approximately 85% SpO_2 —

regardless of the actual true MetHb level. However, in this patient with a measured co-oximetry SaO_2 of 85% and a PaO_2 of 210 mmHg (which should correspond to near-100% oxyhemoglobin by the standard dissociation curve), the SpO_2 reading of 99% from the pulse oximeter is actually the incorrect value. Co-oximetry measures all hemoglobin species directly using multiple wavelengths (typically 4–6) including MetHb, COHb, and HbO_2, and is the gold standard. The PaO_2 of 210 mmHg on supplemental oxygen should produce near-complete saturation unless a significant fraction of hemoglobin is occupied by methemoglobin. Therefore, the co-oximetry SaO_2 of 85% reflects the true functional oxyhemoglobin, while the pulse oximeter is reporting a falsely elevated SpO_2 in the setting of methemoglobinemia.

Question: 1122

Which of the following statements accurately describes the process of myelination in the developing nervous system?

A. Myelination occurs primarily in the spinal cord before the brain.
B. Myelination is completed by the age of 2 years.
C. Myelination is critical for the rapid conduction of nerve impulses.

Answer: C

Explanation: Myelination is essential for the rapid conduction of nerve impulses, allowing for efficient communication between neurons. While myelination begins in utero, it continues into early childhood, affecting both the brain and spinal cord.

Question: 1123

A 2-year-old child with hydrocephalus undergoes MRI under sedation. Which

respiratory pattern most strongly suggests rising intracranial pressure?

A. Biot respirations with irregular periods of apnea
B. Prolonged expiratory phase with wheezing
C. Kussmaul respirations with deep rapid breathing

Answer: A

Explanation: Irregular respirations with unpredictable apnea, known as Biot respirations, suggest brainstem dysfunction from increased intracranial pressure. Hydrocephalus may compress medullary respiratory centers, especially in young children. Kussmaul respirations are more characteristic of metabolic acidosis. Wheezing with prolonged expiration suggests obstructive airway disease rather than intracranial pathology. Recognition of abnormal respiratory patterns is critical because sedation may further depress respiratory drive.

Question: 1124

A 5-year-old boy with sickle cell disease is scheduled for a routine surgical procedure. His preoperative hemoglobin level is 8 g/dL. What is the most appropriate preoperative management to reduce the risk of a vaso-occlusive crisis?

A. Transfusion to achieve a hemoglobin level of at least 10 g/dL
B. Administer hydroxyurea preoperatively
C. Administer intravenous fluids and maintain hydration

Answer: A

Explanation: In patients with sickle cell disease, maintaining a higher hemoglobin level can help reduce the risk of a vaso-occlusive crisis during surgery. Transfusion

to achieve a hemoglobin level of at least 10 g/dL is recommended to improve oxygen delivery and reduce sickling.

Question: 1125

Which hemodynamic effect is associated with the administration of milrinone in a pediatric patient with low cardiac output syndrome?

A. Reduced SVR and increased PVR
B. Reduced SVR and reduced PVR
C. Increased SVR and increased PVR

Answer: B

Explanation: Milrinone is a phosphodiesterase III inhibitor. It increases intracellular cAMP in the myocardium, which increases contractility (inotropy) and lusitropy (relaxation). In the vascular smooth muscle, increased cAMP causes vasodilation. Therefore, milrinone acts as an "inodilator," reducing both systemic vascular resistance (SVR) and pulmonary vascular resistance (PVR) while increasing cardiac output.

Question: 1126

In the neuromuscular system, the distance between the nerve terminal and the muscle surface (the synaptic cleft) is:

A. Greater in neonates than in adults
B. Identical across all pediatric age groups
C. Smaller in neonates than in adults

Answer: A

Explanation: In the neonatal neuromuscular junction, the synaptic cleft is wider, and the secondary subneural folds are less developed (shallower and fewer) compared to the adult junction. This structural immaturity, combined with the presence of fetal-type receptors, contributes to the unique pharmacodynamic profile of muscle relaxants in early life.

Question: 1127

A child with severe traumatic brain injury receives hypertonic saline therapy. What is the principal mechanism by which hypertonic saline reduces intracranial pressure?

A. Selective cerebral venodilation improving venous drainage
B. Osmotic movement of water from cerebral tissue into the intravascular space
C. Decreased cerebrospinal fluid production through choroid plexus inhibition

Answer: B

Explanation: Hypertonic saline creates an osmotic gradient that draws water from edematous cerebral tissue into the intravascular compartment, thereby reducing intracranial pressure. Additional benefits include improved intravascular volume, enhanced cerebral perfusion pressure, and modulation of inflammatory responses. Hypertonic saline does not primarily act through cerebrospinal fluid suppression or venodilation. Careful monitoring is required to avoid excessive hypernatremia and osmotic complications.

Question: 1128

During the preoperative evaluation of a 6-year-old child with Trisomy 21 (Down Syndrome) scheduled for a tonsillectomy, which finding on physical examination or history should most significantly alter your anesthetic plan for airway management?

A. Report of neck pain and a new onset of gait instability
B. Short stature and a history of repeated upper respiratory tract infections
C. Presence of a macroglossia and midface hypoplasia

Answer: A

Explanation: While macroglossia and midface hypoplasia are common in Trisomy 21 and complicate mask ventilation or intubation, the presence of neck pain and gait instability suggests atlantoaxial instability (AAI). Up to 10% to 30% of children with Down Syndrome have AAI due to ligamentous laxity. Symptomatic AAI carries a high risk of permanent spinal cord injury during neck extension for laryngoscopy. This finding necessitates immediate cervical spine stabilization and potentially a modified intubation technique (such as fiberoptic intubation in a neutral position) rather than standard sniffing position maneuvers.

Question: 1129

A 3-year-old child is undergoing induction for a Wilms tumor resection. The anesthesiologist chooses to avoid succinylcholine. What is the most likely oncology-related reason to avoid this agent in a patient who may have had recent vincristine therapy?

A. Potential for exaggerated hyperkalemic response due to chemotherapy-induced neuropathy
B. Vincristine increases the metabolism of succinylcholine, making it ineffective

C. Risk of tumor lysis syndrome

Answer: A

Explanation: Vincristine can cause significant peripheral neuropathy. In any condition involving subacute or chronic denervation or significant neuropathy, the upregulation of extrajunctional acetylcholine receptors can lead to a massive, life-threatening hyperkalemic response following the administration of succinylcholine.

Question: 1130

A neonate is being treated for a supraventricular tachycardia with a drug that is highly bound to alpha-1 acid glycoprotein (AAG). How does the level of AAG in a neonate affect the free fraction of the drug?

A. AAG is not present in neonates, and drugs bind exclusively to fetal hemoglobin
B. AAG levels are significantly lower than in adults, increasing the free fraction
C. AAG levels are 200% of adult levels, decreasing the free fraction

Answer: B

Explanation: Alpha-1 acid glycoprotein (AAG) is the primary binding protein for basic drugs (e.g., local anesthetics, opioids, propranolol). In neonates, AAG levels are approximately half of adult levels. Consequently, for a given total plasma concentration of a basic drug, the free (pharmacologically active and potentially toxic) fraction is significantly higher in the neonate than in the adult.

Question: 1131

What is the most appropriate fluid replacement strategy for a 10 kg child undergoing surgery with significant blood loss?

A. 5 mL/kg of dextrose in water
B. 10 mL/kg of normal saline
C. 20 mL/kg of lactated Ringer's solution

Answer: C

Explanation: For significant blood loss, a bolus of 20 mL/kg of lactated Ringer's solution is appropriate for rapid volume expansion and restoring hemodynamic stability in a pediatric patient.

Question: 1132

A neonate with bladder exstrophy is being prepared for surgery. The anesthesiologist notes that "Latex-free" precautions are strictly mandated. Why are patients with the exstrophy-epispadias complex considered at high risk for latex allergy?

A. The bladder mucosa in exstrophy is highly permeable to latex proteins
B. They undergo multiple surgical procedures and frequent catheterizations starting from birth
C. They have a genetic predisposition to Type I hypersensitivity

Answer: B

Explanation: Children with congenital anomalies like bladder exstrophy or myelomeningocele require numerous surgeries and frequent urinary catheterizations from early infancy. This repeated, chronic exposure to latex-containing products

(gloves, catheters, etc.) significantly increases their risk of developing a life-threatening latex allergy. Current standards of care require that these patients be managed in a latex-free environment from their very first procedure.

Question: 1133

During the induction of anesthesia for a 6-month-old infant, the anesthesiologist notices that the patient's work of breathing increases significantly when the neck is placed in a neutral position on the flat operating table. What anatomical feature is primarily responsible for this obstruction?

A. Macroglossia and a short mandible
B. Narrower nasal passages and adenoid hypertrophy
C. Large occiput causing neck flexion

Answer: C

Explanation: Pediatric patients, particularly infants, have a relatively large head with a prominent occiput. When placed supine on a flat surface, the prominent occiput forces the neck into a flexed position, which can easily obstruct the relatively compliant airway. To maintain a patent airway and achieve the "sniffing position" or a neutral alignment for ventilation, a shoulder roll is often required to compensate for the large occiput, whereas adults usually require a head lift or "donut" under the occiput.

Question: 1134

A 10-year-old child with a history of arrhythmias is scheduled for surgery. Which of

the following monitoring techniques is most appropriate during the procedure?

A. Pulse oximetry only
B. Non-invasive blood pressure monitoring
C. Continuous electrocardiographic monitoring

Answer: C

Explanation: Continuous electrocardiographic monitoring is essential in patients with a history of arrhythmias to detect any intraoperative changes in heart rhythm promptly. This allows for immediate intervention if necessary.

Question: 1135

A child with a history of esophageal atresia/TEF repair presents with a stricture at the anastomosis site. During dilation, the patient suddenly becomes bradycardic and hypotensive. What is the most likely cause?

A. Vagal stimulation from esophageal stretching
B. Esophageal perforation and tension pneumomediastinum
C. Tracheal compression from the dilator

Answer: A

Explanation: Esophageal manipulation and stretching during dilation can trigger a strong vasovagal response, leading to sudden bradycardia and hypotension. While perforation is a serious concern, it usually presents with respiratory distress and changes in ventilation rather than isolated primary bradycardia.

Question: 1136

During the management of a 4-year-old with Klippel-Feil syndrome, which of the following anatomical limitations is most likely to be encountered?

A. Inability to extend the neck due to cervical vertebral fusion
B. Severe tracheal stenosis at the level of the cricoid
C. Limited mouth opening due to TMJ ankylosis

Answer: A

Explanation: Klippel-Feil syndrome is characterized by the congenital fusion of two or more cervical vertebrae. This leads to a short neck, low posterior hairline, and significantly restricted neck range of motion. Direct laryngoscopy can be extremely difficult because the neck cannot be extended into the "sniffing" position.

Question: 1137

During the fetal period, which of the following vessels carries the blood with the highest oxygen saturation (SpO_2)?

A. Umbilical artery
B. Ascending aorta
C. Descending aorta

Answer: B

Explanation: In fetal circulation, the umbilical vein carries oxygenated blood from

the placenta (saturation approx. 80%). Much of this blood bypasses the liver via the ductus venosus and enters the IVC, where it is preferentially shunted across the foramen ovale into the left atrium. This relatively highly oxygenated blood is then pumped by the left ventricle into the ascending aorta to supply the brain and heart. Blood in the descending aorta is a mixture of this blood and the less-oxygenated blood coming through the ductus arteriosus from the right ventricle.

Question: 1138

An 8-year-old child (28 kg) is undergoing posterior spinal fusion for scoliosis with neuromonitoring (SSEP and MEP). The team is using total intravenous anesthesia with propofol and remifentanil infusions, with no volatile agents. Motor-evoked potential (MEP) monitoring suddenly shows bilateral loss of signal amplitude. Before declaring a neurological event, the anesthesia team reviews pharmacological confounders. Which of the following correctly identifies the neuromuscular blocking agent scenario that would produce this MEP change and how it can be distinguished from a true neurological event?

A. Neuromuscular blockade does not affect MEP signals because MEPs are recorded as compound muscle action potentials generated directly from central motor pathways; SSEP signals, not MEPs, are sensitive to neuromuscular blockade
B. Complete neuromuscular blockade (TOF count 0/4) from residual non-depolarizing agent would eliminate MEP signals bilaterally; this is distinguished from true cord injury by the presence of 4/4 train-of-four responses with no fade, confirming adequate neuromuscular transmission
C. Any level of residual neuromuscular blockade would eliminate MEP signals bilaterally because MEPs require complete neuromuscular junction integrity; MEP monitoring should only be performed with zero neuromuscular blocking agent on board, confirmed by TOF count 4/4 with no fade

Answer: B

Explanation: Motor-evoked potentials (MEPs) are recorded as compound muscle action potentials (CMAPs) from peripheral muscles following transcranial electrical stimulation of the motor cortex. The recorded signal must traverse the entire motor pathway — descending corticospinal tracts, anterior horn cells, motor nerves, neuromuscular junction, and muscle. Because MEPs are recorded at the muscle level, neuromuscular blockade directly affects the amplitude and reproducibility of MEP signals. Complete or near-complete neuromuscular blockade (TOF count of 0/4 or 1/4) will eliminate or dramatically reduce MEP amplitudes, mimicking a neurological event. To distinguish pharmacological suppression from true spinal cord injury, neuromuscular monitoring with train-of-four must be performed concurrently. If the TOF count is 0/4, MEP loss may be entirely due to pharmacological blockade. MEP monitoring during spinal surgery requires either no neuromuscular blocking agent or a carefully titrated partial block (some centers use a fixed partial block with TOF count maintained at 2–3/4 for muscle relaxation while preserving MEP recordability). SSEPs are also affected by certain anesthetic agents (particularly volatile agents and TIVA depth) but are less sensitive to neuromuscular blockade than MEPs.

Question: 1139

A pediatric renal transplant recipient becomes hypotensive after reperfusion of the donor kidney. Which hemodynamic target is most important for preserving graft perfusion?

A. Maintenance of adequate mean arterial pressure and intravascular volume
B. Restriction of crystalloid administration to prevent graft edema
C. Induction of deliberate hypocapnia to reduce renal vascular resistance

Answer: A

Explanation: Adequate renal graft perfusion depends on sufficient intravascular volume and mean arterial pressure. Aggressive volume optimization is often required immediately after reperfusion. Hypocapnia may decrease renal blood flow, and excessive fluid restriction risks ischemic injury.

Question: 1140

A 10-year-old with a history of cerebral palsy and severe spasticity is scheduled for a selective dorsal rhizotomy. The surgical plan involves stimulating individual nerve roots and observing the motor response. Which anesthetic plan is necessary for this procedure?

A. Deep volatile anesthesia to prevent patient movement
B. Total intravenous anesthesia (TIVA) without any neuromuscular blocking agents
C. Maintenance of a moderate level of neuromuscular blockade (TOF 2/4)

Answer: B

Explanation: Selective dorsal rhizotomy (SDR) requires the ability to stimulate nerve roots and observe a clear, uninhibited electromyographic (EMG) or clinical motor response. Any neuromuscular blockade would abolish the response, and high concentrations of volatile anesthetics would significantly suppress the spinal cord's excitability. Therefore, a TIVA technique (typically propofol/remifentanil) without muscle relaxants is required to facilitate the surgical mapping.

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