

CLINQUIZ

Pediatric anesthesia

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CASE STUDY

A 4 weeks old preterm infant presented to emergency department (ED) with history of regurgitation after feeds for one week. For the last few days he had had projectile vomiting. His mother revealed that the infant had reduced frequency of urination. On examination baby was irritable, with cold and pale extremities, had decreased skin turgor and slightly sunken eyes. On abdominal palpation, a mass was felt in the epigastrium. Vital signs were; heart rate 145/min, respiratory rate 56/min, BP 76/52 mmHg and capillary filling time 3 sec.

(Please select one best option)

Q 1: How you do classify the grade of dehydration in this child?

- A. Mild
- B. Moderate
- C. Severe
- D. Shock

Q 2: What will be your choice of fluid for this patient to correct his hypovolemia?

- A. 5% Dextrose in water
- B. 0.9% Saline
- C. Dextrose 5%, 0.45% Saline
- D. 10% Dextrose in water

Q 3: The most likely diagnosis in this case is pyloric stenosis, which requires surgical intervention. The infant would require ICU monitoring in postoperative period because of the risk of postoperative apnea, the highest incidence of which is seen in neonates with:

- A. Post-conceptual age (PCA) of 44 weeks with anemia
- B. PCA of 44 weeks without anemia
- C. PCA of 49 weeks
- D. Small for gestational age neonates

Q 4: Complete maturation of the renal system in infants takes place by the age of;

- A. 10 months

- B. 2 years
- C. 3 years
- D. 5 years

Q 5: Which one of following may act as a long-acting muscle relaxant in infants?

- A. Atracurium
- B. Vecuronium
- C. Rocuronium
- D. Mivacurium

Q 6: What is true about the micro cuff tracheal tubes?

- A. Cuff made of PVC, Murphy's eye, cuff more proximal, provides seal at cuff pressure of 25-30 cmH₂O
- B. Cuff made of polyurethane, no Murphy's eye, cuff more distal, provides seal at cuff pressure of <10 cmH₂O
- C. Cuff made of polyurethane, no Murphy's eye, cuff more distal, provides seal at pressure 25-30 cmH₂O
- D. Cuff made of PVC, Murphy's eye, cuff more proximal, provides seal at pressure <15 cmH₂O

Q 7: All are true about sevoflurane except;

- A. It allows rapid induction and emergence in infants and children
- B. Results in formation of Compound A with soda

- lime in low flows
- C. Results in formation of Compound A with soda lime in low flows
- D. It decreases systemic vascular resistance more as compared to isoflurane
- E. It is a good muscle relaxant

Q 8: Infants are at increased risk of local anesthetic (LA) toxicity due to all except;

- A. Immaturity of liver enzymes
- B. Highest CSF volume compared to adults
- C. Low levels of plasma proteins
- D. Increased cardiac output leading to increased systemic uptake

Q 9: The smallest fiberoptic bronchoscope with a suction channel has an outer diameter of:

- A. 1.8 mm
- B. 2.2 mm
- C. 2.8 mm
- D. 3.2 mm.

Q 10: Latest pediatric and neonatal CPR guidelines include all except;

- A. Neonatal resuscitation sequence is A-B-C rather than C-A-B
- B. Compression-ventilation ratio for infants is 3:1
- C. Initial defibrillation energy does is 2-4 J/ kg followed by 4 J/kg
- D. Routine administration of calcium is not recommended

ANSWERS

A 1: (B) - Severity of dehydration is classified on the basis of clinical signs and symptoms;

Mild: Increased thirst, tears present, mucous membranes moist, external jugular veins visible when supine, capillary refill >2 sec centrally.

Moderate: Tacky to dry mucous membranes, decreased tears, pulse rate may be elevated somewhat, fontanelle may be sunken, oliguria, capillary refill time between 2 and 4 sec, decreased skin turgor.

Severe: Tears absent, mucous membranes dry, eyes sunken, tachycardia, slow capillary refill, poor skin turgor, cool extremities, orthostatic to shocky, apathy, somnolence.

Shock: Physiological decompensation, insufficient perfusion to meet end-organ demand, poor oxygen delivery, decreased blood pressure.

Hypotension is a late sign in children because child's ability to produce compensatory vasoconstriction is so effective that central BP remains well-maintained for long.

A 2: (C) -The dehydration of a child with pyloric stenosis results from both fluid and electrolytes losses; especially of H⁺ and Cl⁻ from gastric secretions. After progressive fluid loss, a hypokalemic-hypochloremic metabolic alkalosis develops. Children with severe dehydration have accelerated renal k⁺ and H⁺ losses due to an attempt to retain fluid and Na⁺ ions. Then, as K⁺ deficit develops, the kidney attempts to retain both Na⁺ and K⁺; excreting H⁺ instead of K⁺ which leads to paradoxical aciduria. This cycle can be broken only by adequately replacing fluid and electrolytes before taking up the child for surgery. Administer D₅W with 0.45% NaCl IV 1.5 times the maintenance rate. When urine output is demonstrated, KCl 10-20 mEq/L can be added to this fluid.

A 3: (A) – Post-conceptual age (PCA) is defined as weeks of age after conception till birth + weeks of age after birth. Anemia is a significant risk factor for postoperative apnea but it can be observed in non-anemic infants also until PCA is <44 weeks. Small for gestation infants are defined as babies who are small than normal in size for the gestational age, most commonly as weight below 10th percentile for the gestational age.

A 4: (B) - Renal function is diminished in neonates because of low perfusion pressure and immature glomerular and tubular function. A term neonate has limited ability to concentrate urine and to excrete large water and solute load. These limitations may be explained by limited tubular secretion and by resorption of water, glucose, sodium and bicarbonate. Complete maturation of renal function takes place by about 2 years of age. Thus, the elimination half-lives of drugs that depend on the kidney for elimination may be prolonged in neonates.

A 5: (B) - As volume of distribution of infants is greater compared to adults, the mean residence time (a parameter similar to half-time elimination) of vecuronium was found to be increased in infants according to a pharmacokinetic study. In another study, it was found that a standard intubating dose of 0.01 mg/kg maintained over 90% neuromuscular blockade for almost one hour in infants compared to only 18 min in older children.

A 6: (B) - Characteristics of micro cuff tubes are;

- Cuff is ultrathin polyurethane cuff (10 μm) which does not form folds between the cuff and the tracheal wall.
- The Murphy's eye has been eliminated.
- Cuff is more distal and is short when inflated. It expands or is placed below the subglottis.
- Provides a seal with cuff pressure < 10 cmH₂O.

A 7: (C) - Sevoflurane is halogenated solely with fluorine which reduces its solubility in both fat and blood, thereby increasing the rate of uptake and elimination. Its instability with soda lime results in the formation of compound A, a nephrotoxic substance. It is formed more while using a circle system on low flows (0.5-1.0 L/min). Preferably, sevoflurane should not be used in a fresh gas flow < 1.0 L/min for more than 2 MAC hrs. Decrease in systemic vascular resistance is more with isoflurane as compared to sevoflurane.

A 8: (B) - The immaturity of liver enzymes (cytochrome P450), in neonates and infants contributes to the decreased clearance of amide LAs during the first year of life.

- Total CSF volume is more in children < 15 kg (4 ml/kg vs. 2 ml/kg in adults) leading to greater dilution of LA drug. Additionally infants have higher volume of distribution (ECF) and less fat thereby achieving lower systemic concentration of LA and increased dose requirement, especially of amides.
- Infants < 6 months of age have decreased levels of plasma proteins, which results in a larger free fraction of LA and consequently places this age

group at a greater risk of toxicity. Adult levels of protein binding are reached at about one year of age.

- Children may be at increased risk of toxicity of LA because of their relatively increased cardiac output and increased systemic uptake of the agent which increases amount of LA available to cross the blood-brain barrier.

A 9: (C) - The smallest bronchoscope with a suction channel that can be used to instill topical anesthesia or to insufflate oxygen has an outer diameter (OD) of 2.8 mm and accommodates an endotracheal tube with an ID of 3.5 mm.

A 10: (B) - The 2010 AHA guidelines for CPR and ECC recommend a change in the BLS sequence from A-B-C (Airway, Breathing, Chest compressions) to C-A-B for adults, children and infants **except newborns** because neonatal cardiac arrest is predominantly asphyxial rather than of cardiac origin.

- 3:1 ratio for newborns facilitates provision of adequate minute ventilation, which is considered critical for the vast majority of newborns who have an asphyxial arrest.
- The initial defibrillation energy dose of 2 to 4 J/kg of either monophasic or biphasic waveform is reasonable. For second and subsequent doses, at least 4 J/kg is given.
- Routine calcium administration is not recommended in the absence of documented hypocalcaemia, calcium channel blocker overdose, hypermagnesemia or hyperkalemia.

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