

Are Prior Experience and Subspecialty Training Time Predictive of Pediatric Anesthesia Exit Exam Scores for Rotating CA-2 Residents?

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Abstract

Background: Anesthesiology residency programs commonly have rotations at free-standing children's hospitals to provide and/or supplement their residents' training in pediatric anesthesia. Length and timing of these rotations differ from program to program as can their residents' existing medical knowledge and clinical skills. We predicted that residents with prior pediatric anesthesia experience, who rotate at our pediatric institution for two consecutive months, will score higher on an exit exam compared to residents without prior pediatric experience or those that only rotate for one month.

Methods: A 50-question multiple choice test was created using pediatric questions released from The American Board of Anesthesiology (ABA) written examinations. The test was administered and proctored at the end of each rotation. Study participants came from three different programs: Program A offers prior pediatric anesthesia experience and a one month rotation; Program B – offers prior pediatric anesthesia experience and a two month rotation; and Program C – does not offer prior pediatric anesthesia experience but includes a two month rotation.

Results: The 2014-2015 cohort consisted of 26 rotating second-year clinical anesthesia (CA-2) residents. One resident's exam scores were excluded from this study due to protocol violation. Mean exam scores for Program A, B, and C were 70.5% ± 5.7, 64.2% ± 7.0, and 67.3% ± 4.3, respectively. There was no statistically significant difference in the exit exam scores among the three groups.

Conclusions: Prior pediatric anesthesia experience or length of time for subspecialty rotation was not associated with any significant difference in exit exam scores for CA-2 residents.

Key words: educational assessment, knowledge base, pediatric anesthesia

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Introduction

Anesthesiology residency programs commonly have rotations at free-standing children's hospitals to provide and/or supplement their residents training in pediatric anesthesia. Length and timing of these rotations differ from program to program as can their residents' existing medical knowledge and clinical skills. In an effort to better assess residents' pediatric anesthesia knowledge, upon completion of children's hospital rotation, a web-based exit exam was administered to each resident. We predicted that second-year clinical anesthesia (CA-2) residents with prior pediatric anesthesia exposure, who also rotated at our institution for two consecutive months, would score higher on an exit exam compared to residents without prior pediatric experience or those that only rotated for one month.

Methods

Standardized multiple choice exams are widely used as an educational tool to gauge various levels of competency and have been established as the gold standard in anesthesiology knowledge assessment. The Anesthesia Knowledge Test (AKT), a serial multiple choice knowledge-based exam, is currently used by many anesthesia residency programs to assess the competence and progress of their residents. However, in the subspecialty of pediatric anesthesiology, a universally accepted tool for assessing knowledge gains or deficits during the one or two month residency rotation does not exist. Using a web-based software program, we created a pediatric anesthesia exit exam for CA-2 residents rotating at our institution during their subspecialty training. The 50-question multiple choice exam, encompassing various topics in pediatric anesthesia, was generated using the released question items from previous written examinations from The American Board of Anesthesiology (ABA). Questions were selected to cover the full range of pediatric anesthesia medical knowledge and current relevance. These questions were previously both written and reviewed by pediatric anesthesiology experts, and under the direction of the ABA previously underwent rigorous testing for accuracy, precision and freedom from bias. Our institutional study design team and exam proctors also reviewed all questions for accuracy. Using a web-based platform, the proctored exam was administered to each CA-2 resident at the end of the rotation, and he/she was given 90 minutes to complete the exam. The testing conditions were uniform throughout the academic year for each resident, with the same explanation of instructions by the proctor. The residents that rotated at our institution were from three local academic institutions, all certified by the Accreditation Council for Graduate Medical Education (ACGME). The residents from Program A had prior pediatric anesthesia experience but only rotated for one month; residents from Program B also had prior pediatric anesthesia experience and rotated for two consecutive months; residents from Program C had no prior pediatric anesthesia experience and rotated for two consecutive months at our institution. The scope of prior pediatric anesthesia experience was dependent on each individual program, but typically encompassed healthy pediatric patients for outpatient surgical cases. A one-way ANOVA was used to determine whether there was a statistically significant difference (p -value < 0.05) in mean exam scores between the three groups of residents.

Results

The 2014-2015 cohort of rotating CA-2 residents consisted of 26 total residents. One resident's exam score was excluded from this study because the exam was non-proctored. The overall mean exit exam score was $67.2\% \pm 6.2$. Mean exam scores for Program A (n=8), B (n=9), and C (n=8) were $70.5\% \pm 5.7$, $64.2\% \pm 7.0$, and $67.3\% \pm 4.3$, respectively. There was no statistically significant difference in exit exam scores among the three residency programs as determined by one-way ANOVA [$F(2, 22) = 2.44$, $p = 0.11$].

Discussion

In postgraduate medical education, efforts are continually being made to improve upon the competency assessments of trainees.¹ One important goal of these assessments is to “optimize the capabilities of all learners and practitioners by providing motivation and direction for future learning.”² Van der Vleuten discussed the five criteria necessary to determine usefulness of an assessment tool: reliability, validity, impact on future learning, acceptability to learners and faculty, and costs.³ While no one method is perfect, standardized multiple choice question exams have been successful in determining degrees of competency in medical knowledge and future success in graduate medical education, including within anesthesiology.^{4,5}

Multiple choice question exams (MCQs) are very familiar to anesthesiology trainees who have taken numerous standardized tests in this format. By utilizing complete descriptions of clinical content, MCQs can test beyond basic factual knowledge and uncover more complex cognitive processes used in clinical practice.² A broad range of content areas can be covered in a relatively short amount of time, and by incorporating a web-based platform, administration of the exam can be expedient and seamless. This technology interface also allows for the administrators to obtain results immediately in order to give timely feedback to the examinees. Early identification of individual and institutional weaknesses can be crucial in the outcome of trainee education and career development.^{6,7}

Since the pediatric anesthesia exit exam was compiled from prior ABA examinations, the test questions underwent rigorous testing for accuracy, precision and freedom from bias. While we found that prior pediatric anesthesia exposure or length of time for subspecialty rotation was not associated with any significant difference in exit exam scores for CA-2 residents, a major limitation of this preliminary study was the small sample size. Statistically significant results among the three groups may have been seen with a higher powered study. The study was also limited by some residents having time off for conferences during the rotation, which may have reduced their exposure to different pediatric cases and lectures covering core topics in the field. In future investigation, administering a pre- and post- pediatric subspecialty rotation exam to each resident, to evaluate individual knowledge, will be of greater value.

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Pediatric Anesthesia Exit Exam for CA-2 Residents

1. A 20-kg 6-year old boy is undergoing strabismus surgery under anesthesia with sevoflurane, nitrous oxide, and oxygen. The heart rate suddenly decreases from 85 to 40 bpm. Which of the following is the most appropriate first step in management?
 - A. stop the surgical procedure
 - B. hyperventilate the patient
 - C. increase the depth of anesthesia
 - D. decrease the depth of anesthesia
 - E. administer atropine

2. Which of the following is characteristic of the airway in a 2-month old infant when compared with an adult airway?
 - A. larynx is positioned lower in the neck
 - B. airway is narrowest at cricoid cartilage
 - C. laryngeal mucosa is more tightly adherent
 - D. vocal cords have a more cephalad anterior attachment
 - E. epiglottis is broader

3. A 2500-g, 12-hour old infant is tracheally intubated and mechanically ventilated at a rate of 20/min with an FiO₂ of 0.4 and peak inspiratory pressure of 25 cmH₂O. At birth, amniotic fluid was meconium stained and Apgar scores were 2 and 7. The most recent arterial blood gas levels are PaO₂ 50 mmHg, PaCO₂ 55 mmHg, and pH 7.20. The most appropriate management is to
 - A. perform bronchial lavage
 - B. increase FiO₂
 - C. increase ventilation
 - D. begin intravenous infusion of prostaglandin E1
 - E. administer sodium bicarbonate

4. Compared with a normal child, which of the following is expected during inhalation induction in a child with a 2:1 left-to-right intracardiac shunt?
 - A. decreased anesthetic concentration in pulmonary artery blood
 - B. decreased rate of rise of alveolar anesthetic tension
 - C. no difference in time for anesthetic induction
 - D. increased anesthetic concentration in vena cava blood
 - E. decreased cerebral blood flow

5. A delay in surgery for 24 to 48 hours for preoperative stabilization and preparation is acceptable in each of the following neonatal conditions EXCEPT
 - A. pyloric stenosis
 - B. diaphragmatic hernia
 - C. biliary atresia

- D. tracheoesophageal fistula
 - E. meningomyelocele
6. Which of the following statements concerning the retinopathy of prematurity is true?
- A. it can be prevented by maintaining FiO_2 below 0.4
 - B. the initial lesion is dilation of retinal capillaries
 - C. it is less likely to develop if PaO_2 is maintained below 70 mmHg
 - D. the incidence is unrelated to birth weight
 - E. infants whose postconceptual age has reached 40 weeks are no longer at risk
7. Which of the following findings is most likely in a 3-year old child who has a secundum-type atrial septal defect with 2:1 left-to-right shunt?
- A. pulmonary vascular resistance twice normal
 - B. pulmonary blood flow twice that of systemic blood flow
 - C. mean pulmonary artery pressure twice normal
 - D. right atrial pressure twice normal
 - E. hypoxemia while breathing room air
8. Which of the following statements concerning fetal hemoglobin is true?
- A. it binds with greater affinity to 2,3-DPG than adult hemoglobin
 - B. it shifts the oxyhemoglobin dissociation curve to the left
 - C. it has a P_{50} of 27 mmHg
 - D. it makes up less than 50% of the total hemoglobin in the neonate
 - E. it has less affinity for oxygen than adult hemoglobin
9. A 6-year old boy with spina bifida and a chronic indwelling urinary catheter has severe hypotension and hypoxemia during augmentation cystoplasty. Which of the following is the most likely cause?
- A. latex allergy
 - B. disseminated intravascular coagulation
 - C. venous air embolism
 - D. autonomic neuropathy
 - E. urinary sepsis
10. An infant is delivered by forceps following labor in which variable decelerations were noted. Amniotic fluid was clear. Initial evaluation shows a cyanotic, limp infant with a heart rate of 80 bpm, poor respiratory effort, and grimacing in response to suctioning. The most appropriate method of resuscitation for this newborn is
- A. bag and mask ventilation with oxygen
 - B. volume expansion with normal saline solution 10 mL/kg
 - C. immediate endotracheal intubation
 - D. administration of sodium bicarbonate 1 mEq/kg
 - E. vigorous tactile stimulation

11. The newborn infant of an 18-year old heroin addict has an initial Apgar score of 1. After intubation of the trachea and ventilation with 100% oxygen, the Apgar score is 3 at five minutes. Appropriate management at this time would include administration of each of the following EXCEPT
- A. sodium bicarbonate
 - B. epinephrine
 - C. dextrose 10%
 - D. normal saline solution
 - E. naloxone
12. Which of the following is suggestive of epiglottitis rather than croup?
- A. rectal temperature of 38.5 degrees Celsius
 - B. a 2-year old child with a harsh, barking cough
 - C. subglottic narrowing (steep sign) on lateral neck radiograph
 - D. leukocyte count of 10,000/mm³ with marked lymphocytosis
 - E. a 4-year old child who insists on sitting up and leaning forward
13. Which of the following is the most likely effect of intramuscular ketamine used for induction of anesthesia in a 2-year old child undergoing elective surgery?
- A. decreased intracranial pressure
 - B. bronchoconstriction
 - C. decreased heart rate
 - D. increased salivation
 - E. respiratory depression
14. Which of the following is an effect of hypothermia in neonates?
- A. increased pulmonary vascular resistance
 - B. increased narcotic requirement
 - C. shivering
 - D. decreased duration of neuromuscular blockade
 - E. metabolic alkalosis
15. Thirty-six hours after primary repair of meningomyelocele, a term newborn has frequent periods of apnea lasting 25 seconds and associated oxygen desaturation to 80%. The most likely explanation is
- A. normal postoperative events
 - B. residual anesthetic effect
 - C. loss of cerebrospinal fluid
 - D. obstructive hydrocephalus
 - E. hyperglycemia
16. A full-term neonate has findings suggestive of a congenital diaphragmatic hernia. Initial Apgar score is 2. Which of the following is the most appropriate initial management?

- A. insertion of a chest tube
 - B. spontaneous ventilation through an endotracheal tube
 - C. controlled ventilation by face mask
 - D. placement of an orogastric tube
 - E. controlled ventilation through an endotracheal tube
17. A 2.8-kg newborn undergoes repair of a moderate-sized omphalocele. Intravenous fluid is administered at 14 mL/hr. Forty-five minutes after beginning surgery and before reduction of the omphalocele, arterial blood pressure decreases from 80/40 to 55/30 mmHg. SaO₂ is 98% at an FiO₂ of 0.5. Breath sounds are equal bilaterally. Which of the following is the most likely explanation for the decrease in blood pressure?
- A. compression of the lungs by abdominal contents
 - B. associated congenital cardiac defect
 - C. pneumothorax
 - D. sepsis
 - E. inadequate fluid administration
18. A 3-day old infant is comatose 18 hours after surgical correction of transposition of the great vessels. Tracheal suctioning produces only a tachycardic response. Anesthesia included midazolam 0.5 mg/kg, fentanyl 60 mcg/kg, and pancuronium 0.3 mg/kg. Which of the following is the most appropriate first step in evaluation of this patient?
- A. CT scan of the head
 - B. administration of flumazenil
 - C. train-of-four assessment
 - D. administration of naloxone
 - E. EEG
19. Which of the following should be included in the preoperative management of a 12-year old patient with Duchenne's muscular dystrophy who is unable to ambulate?
- A. liver function profile
 - B. dantrolene prophylaxis
 - C. determination of serum potassium concentration
 - D. determination of serum creatine kinase concentration
 - E. echocardiography
20. Which of the following results in the greatest increase in right-to-left shunting in an infant with cyanotic heart disease?
- A. myocardial depression
 - B. decreased pulmonary vascular resistance
 - C. increased heart rate
 - D. hemodilution
 - E. decreased systemic vascular resistance

21. In a 5-kg boy with Treacher Collins syndrome who is to undergo cleft palate repair, endotracheal intubation is best accomplished with
- sevoflurane anesthesia with spontaneous ventilation
 - propofol and succinylcholine rapid sequence intravenously
 - awake nasal intubation after topical anesthesia
 - light isoflurane anesthesia and a muscle relaxant
 - nasal intubation after administration of ketamine intramuscularly
22. A 5-year old child undergoes strabismus correction during spontaneous ventilation with sevoflurane, nitrous oxide 50%, and oxygen 50%. Intravenous atropine 0.2 mg is administered after inhalational induction. Ten minutes after incision, heart rate decreases from 110 bpm to 40 bpm. Which of the following is the most likely cause?
- paradoxical response to a small dose of atropine
 - traction on an extraocular muscle
 - administration of phenylephrine eye drops
 - inadvertent external pressure on the carotid sinus
 - sinoatrial node depression by volatile anesthetic
23. Which of the following is the most common initial manifestation of malignant hyperthermia?
- red discoloration of urine
 - ventricular irritability
 - increased EtCO₂
 - hyperkalemia
 - increased distal esophageal temperature
24. A newborn is in respiratory distress. Examination shows a scaphoid abdomen, cyanosis while breathing oxygen by mask, and heart sounds in the right hemithorax. Which of the following is the most appropriate next step?
- tracheal intubation and assisted ventilation
 - tracheal intubation and expansion of the left lung
 - insertion of a chest tube on the left side
 - assisted ventilation with a bag and face mask
 - insertion of a nasogastric tube
25. A 13-year old African American boy has severe abdominal pain after debridement of an open fracture of the lower extremity. His hemoglobin concentration is 10 g/dL and a peripheral blood smear shows elongated crescent-shaped erythrocytes. The most appropriate initial therapy is
- blood transfusion
 - dopamine infusion
 - sodium bicarbonate administration
 - high-dose corticosteroid administration

- E. volume loading with crystalloid
26. Inhalation induction of anesthesia is more rapid in a 6-month old infant than in an adult because infants have
- A. greater ratio of alveolar ventilation to functional residual capacity
 - B. lower distribution of cardiac output to vessel-rich organs
 - C. greater solubility of anesthetic in blood
 - D. greater ratio of blood volume to body weight
 - E. lower anesthetic requirements
27. Compared with normal adults, which of the following characteristics of neonates best explains the more rapid inhalational induction in neonates?
- A. greater perfusion to vessel-rich tissues
 - B. greater cardiac index
 - C. greater ratio of alveolar ventilation to functional residual capacity
 - D. less lean body mass
 - E. greater metabolic rate
28. Which of the following findings is most hazardous in premature infants?
- A. umbilical arterial blood PaO₂ of 50 mmHg
 - B. umbilical arterial blood PaCO₂ of 45 mmHg
 - C. hematocrit of 55%
 - D. rectal temperature of 35 degrees Celsius
 - E. umbilical arterial systolic pressure of 60 mmHg
29. A 35-kg child requires mechanical ventilation with 100% oxygen at a tidal volume of 350 mL and a rate of 20 breaths per minute during a severe asthma attack. The most likely cause of severe hypotension after initiating mechanical ventilation is
- A. increased pulmonary vascular resistance
 - B. inadequate expiratory time
 - C. tension pneumothorax
 - D. respiratory alkalosis
 - E. hypoxic circulatory depression
30. Which of the following decreases right-to-left shunt through a patent ductus arteriosus in a neonate?
- A. arterial hypotension
 - B. positive end-expiratory pressure
 - C. respiratory alkalemia
 - D. arterial hypoxemia
 - E. metabolic acidemia

31. A child has tachypnea immediately after reintubation for intractable laryngospasm. Oxygen saturation is 78% at an FiO₂ of 1.0. A radiograph of the chest taken 15 minutes later is most likely to show
- pneumothorax
 - bilateral pleural effusions
 - patchy central infiltrates of the right upper lobe
 - diffuse homogenous pulmonary infiltrates
 - segmental atelectasis at both lung bases
32. A 2.8-kg, 8-hour infant undergoes laparotomy for a ruptured omphalocele. Following primary closure of the abdominal wall, arterial blood gases are PaO₂ 40 mmHg (FiO₂ 0.6), PaCO₂ 55 mmHg, and pH 7.1. Blood pressure is 30/20 mmHg. After increasing the FiO₂, the most appropriate action would be to
- withdraw the endotracheal tube 1 cm
 - obtain a radiograph of the chest immediately
 - assess the patient for coexisting congenital heart disease
 - administer lactated Ringer's solution 15 mL/kg
 - ask the surgeon to reopen the wound
33. Which of the following complications of caudal anesthesia with 0.25% bupivacaine is more likely in children than adults?
- intravascular injection
 - neurotoxicity
 - total spinal block
 - systemic toxicity
 - profound motor block
34. An 18-month old with Tetralogy of Fallot is anesthetized with sevoflurane and nitrous oxide. Following intubation oxygen saturation decreases abruptly from 85% to 45%. The most effective treatment is
- intravenous epinephrine
 - discontinuation of sevoflurane
 - positive end-expiratory pressure
 - intravenous phenylephrine
 - hyperventilation
35. Which of the following statements best describes testing for susceptibility for malignant hyperthermia?
- live skeletal muscles are required for testing
 - the MH gene is located on the X chromosome

- C. a normal serum creatine phosphokinase concentration eliminates the need for muscle biopsy
 - D. succinylcholine is used to stimulate muscle obtained on biopsy for MH
 - E. muscle biopsy is appropriate in children younger than 1 year
36. A 2600-g neonate is to undergo surgical repair of a small gastroschisis. The infant is preoxygenated with 100% oxygen. Arterial hemoglobin desaturation is noted during laryngoscopy after rapid sequence induction. Which of the following is the most likely cause?
- A. high fetal hemoglobin concentration
 - B. high ratio of oxygen consumption to functional residual capacity
 - C. patent ductus arteriosus
 - D. low functional residual capacity in milliliters per kilogram
 - E. poor thoracic compliance
37. Which of the following is the primary physiologic response in a neonate exposed to a hypothermic environment?
- A. increased 2,3-DPG concentration in erythrocytes
 - B. shivering
 - C. vasoconstriction
 - D. metabolism of brown fat
 - E. hyperventilation
38. Compared with adult hemoglobin, which of the following is characteristic of fetal hemoglobin?
- A. it has a greater oxygen-carrying capacity
 - B. it is more likely to sickle
 - C. it has a lower P50
 - D. it unloads oxygen more readily at the tissues
 - E. it is more likely to cause an artificial increase in SpO₂
39. An 8-kg, 1-year old child has a measured blood loss of 50 mL during the first two hours of a rectal pull-through operation. Preoperative hematocrit was 31%. Balanced saline solution 150 mL has been administered for replacement. Urine output has been 2 mL for the last hour, heart rate is 160 bpm, and blood pressure is 40/15 mmHg. The most appropriate fluid therapy is
- A. balanced salt solution and mannitol
 - B. balanced salt solution
 - C. 5% dextrose in 0.45% saline solution
 - D. 25% albumin
 - E. packed red blood cells

40. Compared with similar use in adults, routine use of succinylcholine in children is hazardous because of the increased risk for which of the following?
- A. pulmonary aspiration
 - B. pseudocholinesterase deficiency
 - C. phase II block
 - D. anaphylactoid reaction
 - E. undiagnosed myopathy
41. Acute epiglottitis usually
- A. requires immediate awake intubation by direct laryngoscopy in the emergency department
 - B. occurs in children 2 to 4 years of age
 - C. has a viral etiology
 - D. requires a lateral radiograph of the neck for diagnosis
 - E. is treated effectively with racemic epinephrine
42. Which of the following best explains why neonates are at greater risk than adults for hypothermia during surgical procedures?
- A. greater body surface relative to body mass
 - B. less insulation by adipose tissue
 - C. greater cutaneous vasodilation at equal MAC concentrations of volatile anesthetics
 - D. inability to increase metabolic rate
 - E. greater dependence on shivering to produce heat

Pediatric Anesthesia Exit Exam for CA-2 Residents

43. A 2.2-kg, 6-hour old neonate is to undergo gastrostomy followed by repair of a tracheoesophageal fistula. During induction with sevoflurane, air, and oxygen, the abdomen becomes distended. Appropriate management is to
- A. allow the patient to breathe spontaneously by mask until gastrostomy
 - B. insert an orogastric tube
 - C. control ventilation by mask until gastrostomy
 - D. intubate and assist spontaneous ventilation
 - E. intubate and control ventilation
44. A 2.3-kg, 1-day old term infant requires repair of a gastroschisis. Which of the following combinations is most appropriate for intraoperative fluid management?
- A. lactated Ringer's solution for maintenance and albumin 5% for replacement of third space losses
 - B. lactated Ringer's solution for maintenance and replacement of third space losses
 - C. normal saline solution for maintenance and lactated Ringer's solution for replacement of third space losses

- D. dextrose 10% in water for maintenance and lactated Ringer's solution for replacement of third space losses
 - E. dextrose 5% in water for maintenance and lactated Ringer's solution for replacement of third space losses
45. In children with preoperative upper respiratory tract infections, which of the following is associated with the greatest risk for postoperative airway obstruction?
- A. inadequate airway humidification
 - B. age less than 1 year
 - C. head and neck surgery
 - D. surgery for more than two hours
 - E. endotracheal intubation
46. A 1-month old infant becomes hypoxemic faster during apnea than an adult. Which of the following is the primary cause of this difference?
- A. resting PaO₂ in an infant is lower than that of an adult
 - B. the hemoglobin dissociation curve in an infant is shifted to the right
 - C. the number of alveoli in an infant is 12% of that in an adult
 - D. functional residual capacity in an infant is half that of an adult
 - E. metabolic rate in an infant is twice that of an adult

Pediatric Anesthesia Exit Exam for CA-2 Residents

47. Which of the following features is characteristic of the airway in a neonate?
- A. larger tongue relative to the head than an adult
 - B. glottis that is located at the level of the C6 vertebral body
 - C. more posterior glottis than that of an adult
 - D. laryngeal mucosa that is densely adherent to the cartilages
 - E. narrowest portion of the airway that is located at the arytenoid cartilages
48. A 6-year old child with severe cerebral palsy is scheduled for general anesthesia. He is at increased risk for each of the following EXCEPT
- A. hypersensitivity to central nervous system depressants
 - B. postoperative pulmonary complications
 - C. poor function of laryngeal reflexes
 - D. gastroesophageal reflux
 - E. succinylcholine-induced hyperkalemia
49. During an inguinal hernia repair, a newborn infant will have larger fluid requirements (in mL/kg) than an adult because of relatively greater
- A. lean body mass
 - B. metabolic rate
 - C. sodium loss
 - D. third space losses

- E. insensible water loss
50. Which of the following statements concerning caudal anesthesia in children is true?
- A. it is contraindicated in infants younger than 1 year of age
 - B. delay of postoperative micturition occurs in most patients
 - C. the dural sac extends further caudad than in adults
 - D. the sensory level of analgesia is poorly correlated with the dose of local anesthetic
 - E. it is technically difficult because of poorly defined sacral anatomy

ANSWER KEY

- | | |
|-------|-------|
| 1. A | 26. A |
| 2. B | 27. C |
| 3. C | 28. D |
| 4. C | 29. B |
| 5. E | 30. C |
| 6. C | 31. B |
| 7. B | 32. E |
| 8. B | 33. C |
| 9. A | 34. D |
| 10. A | 35. A |
| 11. E | 36. B |
| 12. E | 37. D |
| 13. D | 38. C |
| 14. A | 39. B |
| 15. D | 40. E |
| 16. E | 41. B |
| 17. E | 42. A |
| 18. C | 43. D |
| 19. E | 44. D |
| 20. E | 45. B |
| 21. A | 46. E |
| 22. B | 47. A |
| 23. C | 48. E |
| 24. A | 49. B |
| 25. E | 50. C |