Question Bank

1. A 55-year-old business executive is scheduled for colonoscopy and polypectomy under general anesthesia. A bruit is auscultated over the right carotid artery on physical examination. The patient is otherwise healthy. Which of the following would be the most appropriate course of action?

A. Cancel surgery and obtain coronary angiogram
B. Cancel surgery and obtain Doppler ultrasound carotid blood flow studies
C. Cancel surgery and obtain dobutamine stress echocardiogram
D. Proceed with surgery and obtain a carotid angiogram postoperatively
E. Proceed with surgery

Explanation
Surgical treatment of carotid artery stenosis greatly decreases the risk of stroke, especially in men with a stenosis diameter greater than 70%. Studies show a high rate of stroke in patients with asymptomatic carotid stenosis greater than 75%, and 80% of carotid atherothrombotic strokes occur without warning. The Asymptomatic CarotidAtherosclerosis Study, the largest completed clinical trial, demonstrated that patients with asymptomatic carotid stenosis (≥ 60%) who were treated with carotidendarterectomy and aspirin have a reduced 5-year risk of ipsilateral stroke compared with patients treated with aspirin alone (5.1% versus 11.0%). Doppler studies also show that 70% to 75% stenosis represents the point at which a pressure drop across the stenosis is likely to occur. Thus, if collateral circulation is not adequate, low-flow transient ischemic attacks and infarcts occur. It would be considered most appropriate to further study the patient's carotid artery disease before proceeding with an elective case. Although ischemic heart disease is a major cause of morbidity and mortality following carotid endarterectomy, dobutamine stress echocardiography or coronary angiogram studies are not routinely obtained. Exceptions to this practice include the following: patients with unstable angina, recent myocardial infarction, with evidence of ongoing ischemia, decompensated congestive heart failure, and significant valvular disease (*Hines: Stoelting's Anesthesia and Co-Existing Disease, ed 5, pp 152-155; Miller: Anesthesia, ed 6, pp 2099-2100)*.
Answer: B

2. An 89-year-old man with a history of transient ischemic attacks is scheduled to undergo a carotid endarterectomy under general anesthesia. Which of the following would be appropriate in the anesthetic management of this patient?

A. Hyperventilation of the lungs to a $PaCO_2$ of 30 mm Hg to reduce ICP
B. Injection of local anesthetic around the carotid body to prevent bradycardia
C. Initiation of deliberate hypotension (after induction of anesthesia) to reduce bleeding
D. Induction of anesthesia with sodium thiopental
E. Permissive hypercapnia to a $PaCO_2$ of 50 mm Hg to promote the Robin Hood phenomenon

Explanation

General anesthesia can be induced safely in patients with carotid artery disease using intravenous anesthetics, such as thiopental, midazolam, propofol, or etomidate. Isoflurane, in conjunction with N_2O or opioids, is a good choice for maintenance of anesthesia in these patients, because critical CBF is reduced during isoflurane, sevoflurane, or desflurane anesthesia, which may provide some cerebral protection. Arterial blood pressure and $PaCO_2$ should be maintained in the normal ranges for each patient because the vasculature within ischemic regions of the brain have lost the ability to autoregulate CBF and respond to changes in $PaCO_2$. Marked reductions in arterial blood pressure may reduce CBF (especially via collateral channels) to ischemic brain tissue. Theoretically, if $PaCO_2$ is increased from normal, cerebral blood vessels surrounding the region of ischemia that retain normal CO_2 responsiveness will dilate, diverting regional cerebral blood flow away from the ischemic brain tissue (i.e., steal phenomenon). Conversely, if the $PaCO_2$ is reduced from normal, the cerebral blood vessels surrounding the ischemic brain tissue will constrict, diverting rCBF to ischemic areas of the brain (inverse steal phenomenon or Robin Hood effect). Hyperventilating the lungs in an attempt to produce the inverse steal phenomenon is not recommended because the actual effect may be unpredictable and supportive evidence in humans that this is beneficial is lacking. The carotid sinus (not carotid body) baroreceptor reflex can be blunted by intravenous injection of atropine or by local infiltration of the area of the carotid sinus with a local anesthetic (*Cottrell: Anesthesia and Neurosurgery, ed 4, pp 460-461, 464-465*).
Answer: D

3. The anterior and posterior spinal arteries originate from the

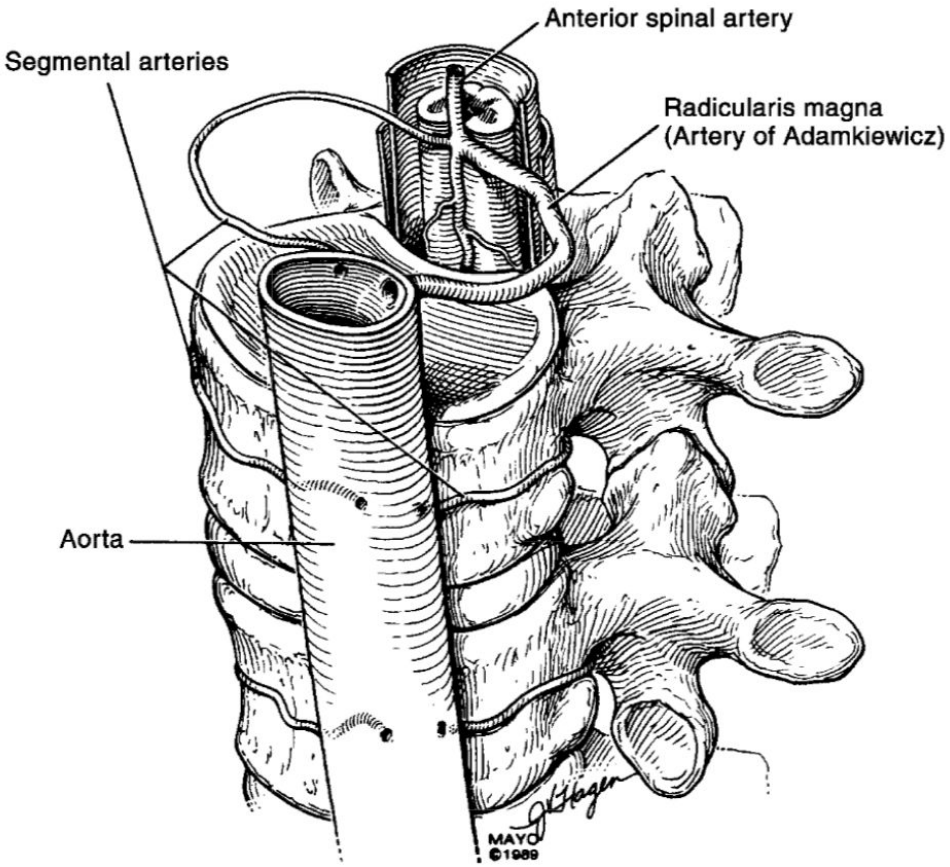
A. Common carotid and vertebral arteries, respectively
B. Internal carotid and vertebral arteries, respectively
C. Internal carotid and posterior cerebral arteries, respectively
D. Vertebral and anterior cerebellar arteries, respectively
E. Vertebral, radicular arteries and the posterior inferior cerebellar arteries, respectively

Explanation
The one anterior spinal artery supplies about 75% of the blood flow to the spinal cord (motor tracts) and arises from the vertebral arteries and radicular arteries from the aorta. It descends in front of the anterior longitudinal sulcus of the spinal cord. The two posterior spinal arteries supply about 25% of the blood flow to the spinal cord (sensory tracts) and arise from the posterior and inferior cerebellar arteries, the vertebral arteries, and the radicular arteries (*Barash: Clinical Anesthesia, ed 5, p 958; Miller: Anesthesia, ed 6, pp 2086-2087*).
Answer: E

4. The artery of Adamkiewicz most frequently arises from the aorta at which spinal level?

A. T1-T4
B. T5-T8
C. T9-T12
D. L1-L4
E. L5-S3

Explanation



The artery of Adamkiewicz is also called the arteria radicularis magna and is one of the "feeder" arteries for the anterior spinal artery. Damage to this artery can lead to ischemia in the thoracolumbar region and may result in paraplegia. The origin of this artery is variable (e.g., T9-T12 in 75% of cases, L1-L2 in 10% of cases) (*Barash: Clinical Anesthesia, ed 5, p 958; Miller: Anesthesia, ed 6, p 2087*).
Answer: C

5. A 72-year-old male patient with a history of myocardial infarction 12 months earlier is scheduled to undergo elective repair of a 6-cm abdominal aortic aneurysm under general anesthesia. When would this patient be at highest risk for another myocardial infarction?

A. On induction of anesthesia
B. During placement of the aortic cross-clamp
C. Upon release of the aortic cross-clamp
D. 24 hours postoperatively
E. On the third postoperative day

Explanation
For reasons that are not fully understood, patients who have sustained a myocardial infarction and subsequently undergo surgery are most likely to have another infarction on the third postoperative day (*Stoelting: Basics of Anesthesia, ed 5, p 367*).
Answer: E

6. A 72-year-old male undergoes emergency repair of an abdominal aortic aneurysm. In the first hour after release of the suprarenal cross-clamp, urine output is only 10 mL. After administration of furosemide 20 mg IV, urine output increases to 100 mL/hr. Urine [Na^+] is 43 mEq/L and urine osmolality is 210 mOsm/L. The most likely cause of the initial oliguria is

A. Fluoride toxicity
B. Renal hypoperfusion
C. Acute tubular necrosis
D. Increased ADH
E. Impossible to differentiate

Explanation
In the absence of diuretics, oliguria associated with urine sodium concentration greater than 40 mEq/L and urine osmolality less than 400 mOsm/L is strongly suggestive of intrinsic renal disease (e.g., acute tubule necrosis) whereas prerenal causes have urine sodium concentration less than 20 mEq/L and urine osmolality greater than 400 mOsm/L. Furosemide, mannitol and dopamine, however, obscures the accurate diagnosis (*Hines: Stoelting's Anesthesia and Co-Existing Disease, ed 5, pp 325-327; Stoelting: Basics of Anesthesia, ed 5, pp 430-431*).
Answer: E

7. A 62-year-old male is brought to the ICU after elective repair of an abdominal aortic aneurysm. His vital signs are stable, but he requires a sodium nitroprusside infusion at a rate of 10 µg/kg/min to keep the systolic blood pressure below 110 mm Hg. The Sao_2 is 98% with controlled ventilation at 12 breaths/min and an Fio_2 of 0.60. After 3 days, his Sao_2 decreases to

85% on the pulse oximeter. Chest x-ray film and results of physical examination are unchanged. Which of the following would most likely account for this desaturation?

A. Cyanide toxicity
B. Thiocyanate toxicity
C. O_2 toxicity
D. Thiosulfate toxicity
E. Methemoglobinemia

Explanation
The metabolism of nitroprusside in the body requires the conversion of oxyhemoglobin (Fe^{++}) to methemoglobin (Fe^{+++}). The presence of sufficient quantities of methemoglobin in the blood will cause the pulse oximeter to read 85% saturation regardless of the true arterial saturation. Cyanide toxicity is also a possibility in any patient who is receiving nitroprusside. Cyanide toxicity should be suspected when the patient develops metabolic acidosis or becomes resistant to the hypotensive effects of this drug despite a sufficient infusion rate. This can be confirmed by measuring the mixed venous Pao_2, which would be elevated in the presence of cyanide toxicity. Thiocyanate toxicity is also a potential hazard of nitroprusside administration in patients with renal failure. Patients suffering from thiocyanate toxicity display nausea, mental confusion, and skeletal-muscle weakness (*Miller: Anesthesia, ed 6, pp 1450, 2187; Stoelting: Pharmacology and Physiology, ed 4, pp 357-358*).
Answer: E

8. A 62-year-old patient scheduled for elective repair of an abdominal aortic aneurysmdevelops a wide complex regular tachycardia (heart rate 150) during induction of anesthesia. Blood pressure is 110/78. Which of the following drugs would be most useful in the management of this dysrhythmia?

A. Lidocaine, 100 mg IV
B. Amiodarone, 150 mg IV over 10 minutes
C. Adenosine, 6 mg rapidly over 3 seconds
D. Verapamil, 5 to 10 mg IV
E. Esmolol, 35 mg IV

Explanation
The patient described in this question has a wide complex tachycardia of undetermined origin. As this patient appears to be hemodynamically stable and has an uncertain rhythm, amiodarone 150 mg IV over 10 minutes, repeated as needed to a maximum dose of 2.2 g IV over 24 hours is recommended. (*2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 112: IV69-IV76, 2005; Miller: Anesthesia, ed 6, p 1404; Hensley: Cardiac Anesthesia, ed 4, p 92).*
Answer: B

9. A 67-year-old patient is mechanically ventilated in the ICU 2 days after repair of a ruptured abdominal aortic aneurysm. To maintain PaO_2 in the 60 to 65 range, 10 cm H_2O positive end-expiratory pressure (PEEP) is added to the ventilator cycle. The patient's blood pressure has averaged 110/65 before addition of PEEP. After addition of PEEP, the blood pressure is noted to slowly fall to an average of approximately 95/50. The best explanation for this decrease in blood pressure is

A. Tension pneumothorax
B. Decreased venous return to the heart
C. Increased afterload on the right side of the heart
D. Increased afterload on the left side of the heart
E. Decreased cardiac output from global myocardial ischemia

Explanation
Positive end-expiratory pressure (PEEP) is the maintenance of positive airway pressure during the entire ventilator cycle. The addition of PEEP to the ventilator cycle is often recommended when PaO_2 is not maintained above 60 mm Hg, when breathing an $FIO_2$of 0.50 or greater. Although not completely understood, PEEP is thought to increase arterial oxygenation, pulmonary compliance, and FRC by expanding previously collapsed but perfused alveoli, thereby decreasing shunt and improving ventilation/perfusion matching. An important adverse effect of PEEP is a decrease in arterial blood pressure caused by a decrease in venous return, left ventricular filling and stroke volume, and cardiac output. These effects are exaggerated in patients with decreased intravascular fluid volume. Other potential adverse effects of PEEP include pneumothorax, pneumomediastinum, and subcutaneous emphysema (*Miller Anesthesia, ed 6, pp 2820-2821; Stoelting: Basics of Anesthesia, ed 5, p 596*).
Answer: B

Collected from Hall's Anesthesia: A Comprehensive Review

*For additional questions, see Vascular Anesthesia chapter in Matthes' "Big Blue" review (available in anesthesia library)