

Daily Anesthesia Question

Question: Monday, October 31

What surgical procedures (excluding eye surgeries) are associated with increased incidence of postoperative visual loss?

Answer:

Postoperative visual loss is one of the most devastating complications that has been reported to occur after cardiopulmonary bypass, neck dissection, general surgical abdominal procedures, hip arthroplasty, craniotomies, thyroidectomy and prone spine cases. The incidence of symptomatic postoperative visual loss varies depending upon the population studied and has been reported as low as one in 60,965 for all nonocular operations and as high as 3.6 percent in cardiopulmonary bypass cases. Atheromatous, or air emboli, prolonged hypotension and anemia, inadequate venous drainage of the globe and direct pressure to the eye have all been implicated as causative factors.

References:

Lee LA. Postoperative Visual Loss Data Gathered and Analyzed. ASA vol. 64;09, 2000.

No Question Tuesday, October 30

No question Monday, October 29

Question: Friday, October 26

45 year old male with ASH (asymmetric septal hypertrophy) syndrome and pacemaker with AICD capabilities is scheduled for knee surgery under general anesthesia. What intraoperative measures will you consider to prevent malfunction of the implantable electrical generator?

Answer:

The intraoperative key points for a patient with a cardiac generator are:

1. monitor cardiac rhythm/ peripheral pulse/ effective cardiac output with pulse oxymeter/ a-line
2. disable the "artifact filter" on the EKG monitor
3. avoid use of monopolar electro-surgery unit
4. use bipolar electro-surgery unit, if possible/ if not possible, then pure cut is better than "blend" or "coag"
5. place the electro-surgery unit current return pad in such a way to prevent electricity from crossing the generator-heart circuit
6. if the electro-surgery unit causes ventricular oversensing, pacer quiescence, or tachycardia reprogram the device with a magnet
7. external pacemaker/ defibrillation pads should be applied on the patient at least 5 cm away from the generator

Do not forget to have the device interrogated by a competent authority postoperatively!

References:

1. Rozner M. The patient with a cardiac pacemaker or implanted defibrillator and management during anesthesia. *Current Opinion in Anesthesiology* 2007; 20:261-268

Question: Thursday, October 25

What does affect the volume of distribution of a medication in obese patients?

Answer:

Volume of distribution is an expression of the characteristics of a drug in the body calculated by dividing the dose of a drug by the resulting plasma concentration prior to elimination.

A drug that is lipid soluble will concentrate in the tissues, resulting in a low plasma concentration, and thus a high volume of distribution. Due to this low effective plasma concentration, the dose of drugs like thiopental (highly lipophilic) often need to be increased. Factors that can affect the volume of distribution of drugs in obese individuals include:

- increased overall lipid tissue
- increased lean body mass
- increased blood volume and cardiac output
- reduced total body water
- alterations in plasma protein binding
- overall lipophilicity of drug

Reference:

Blouin RA, Kolpek JH, Mann HJ. Influence of obesity on drug disposition. *Clin Pharm* 1987; 6:706-14.

Question: Wednesday, October 24

What is the mechanism of action of Clopidogrel? (Plavix)

Answer:

Clopidogrel blocks irreversibly the adenosine ADP receptor on platelet cell membranes. This ADP receptor (P2Y₁₂) is important in platelet aggregation. The blockade of this receptor inhibits platelet aggregation by blocking activation of the glycoprotein IIb/IIIa pathway.

No Tuesday question

Question: Monday, October 22

What are the indications of repeating dose of Dantrolene in a case of malignant hyperthermia?

Answer:

During acute phase therapy of malignant hyperthermia, the initial dose of 2.5 mg/ kg Dantrolene should be repeated until the signs of MH are controlled (hyperthermia, metabolic acidosis, increased CO₂, rigidity, trismus, masseter spasm). Sometimes more than 10 mg/kg (up to 30 mg/kg) is necessary.

During post acute phase the patient should be observed in an ICU for at least 24 hours due to risk of recrudescence and Dantrolene 1 mg/kg q 4-6 hours or 0.25 mg/kg/hour by infusion for at least 24h.

Reference:

MHAUS – Malignant Hyperthermia Association of United States 1-800-MH-HYPER

Question: Friday, October 19

How does dead space change when the neck is extended and jaw protruded?

Answer:

Extended neck and jaw protrusion cause a twofold increase in dead space (therefore an increase in P CO₂ arterial – expired gradient) compared with to a flexed neck and depressed chin.

Question: Thursday, October 18

What are the agents available for acute tocolysis?

Answer:

Halogenated anaesthetic agents were used earlier and these have been largely replaced by betasympathomimetic agents, magnesium sulphate and nitroglycerin. Recently, oxytocin antagonists (atosiban), calcium-channel blockers and cyclo-oxygenase inhibitors are being increasingly used in the suppression of preterm labor.

Reference:

Chandrabaran, Edwin; Arulkumaran, Sabaratnam. Acute tocolysis. Current Opinion in Obstetrics and Gynecology. 17(2), April 2005, p 151–156

Question: Wednesday, October 17

What are the factors that govern O₂ myocardial supply?

Answer:

O₂ supply is a product of O₂ content of the blood and coronary blood flow. In summary the following are the main determinants of myocardial O₂ supply:

1. heart rate (changes in HR and LVEDP affect both: supply and demand)
2. O₂ content
 - Hemoglobin,
 - O₂ saturation
 - PaO₂
3. coronary blood flow

$$\text{CPP} = \text{DBP} - \text{LVEDP}$$

CVR

LVEDP= left ventricular end diastolic pressure

CPP=coronary perfusion pressure

CVR=coronary vascular resistance

PaO₂=partial pressure of O₂ in blood

Question: Tuesday, October 16

You plan to perform an axillary block for AV fistula. Describe the position of the nerves (needed to be blocked) in relationship to axillary artery.

Answer:

At the level of distal axilla, where the axillary block is undertaken, the axillary artery can be visualized as indicating the center of a 4 quadrant neurovascular bundle. A mnemonic that is useful in remembering the position of the nerves is "M&M are tops":

Musculocutaneous nerve is found in the 9 to 12 quadrant in the substance of coracobrachialis muscle; the Median nerve is most often found in the 12 to 3 quadrant. The Ulnar nerve is in the 3 to 6 quadrant; and the Radial nerve is located in the 6 to 9 quadrant.

M&M

R / U

Reference:

Brown D. Atlas of regional anesthesia. 1999, 51-55.

Question: Monday October 15

What is the clinical application of type B natriuretic peptide?

Answer:

Observational studies have suggested that, when used in conjunction with other clinical information, B-type natriuretic peptide levels may be useful in establishing or ruling out the diagnosis of heart failure in patients with acute dyspnea. B-type natriuretic peptide is a 32-amino-acid polypeptide secreted by the cardiac ventricles in response to ventricular volume expansion and pressure overload. The levels of B-type natriuretic peptide are elevated in patients with left ventricular dysfunction, and the levels correlate with both the severity of symptoms and the prognosis. Used in conjunction with other clinical information, rapid measurement of B-type natriuretic peptide in the emergency department improved the evaluation and treatment of patients with acute dyspnea and thereby reduced the time to discharge and the total cost of treatment.

Reference:

Mueller C. et al. Use of B-Type Natriuretic Peptide in the Evaluation and Management of Acute Dyspnea. 350:647-657, Feb 12, 2004

Question: Friday, October 12

Is the gas flow in the CO2 absorber (circle breathing system) bi-directional?

Answer:

- a. yes
- b. no
- c. depends on whether ventilation is spontaneous or mechanical
- d. depends on whether patient is lightly anesthetized

Correct answer:

A.

Question: Thursday, October 11

How is intravascular volume status assessed in neonates?

Answer:

Blood pressure is not a reliable measure of volume in neonates. If the anterior fontanelle is sunken, skin turgor is decreased, and the infant cries without visible tears, the diagnosis is dehydration. Capillary refill after blanching of the big toe should be less than 5 seconds. The extremities should not be significantly cooler than the rest of the body. Finally the skin should look pink and well perfused, not pale, mottled or cyanotic.

Question: Wednesday, October 10

What are the factors associated with increased risk of perioperative corneal abrasion?

Answer:

Eye injury occurs more frequently in association with head and neck surgery and is more likely to occur when the patient is positioned laterally, undergoes general lengthy anesthesia, and has surgery on Monday. These are the results of the 60,965 patients retrospective study. Future studies of the cause of these injuries, if performed, preferably would be done in an entirely prospective manner.

Reference:

Roth S, et al. Eye Injuries after Nonocular Surgery: A Study of 60,965 Anesthetics from 1988 to 1992. *Anesthesiology*:85(5) 1996;1020-1027

Question: Tuesday, October 9

What methods can be employed to treat maternal hypotension?

Answer:

The expansion of intravascular volume, the use of left lateral uterine displacement, and the administration of vasoactive medications have been utilized with variable success in preventing maternal hypotension. Although the effectiveness of intravascular volume preloading for the prevention of maternal hypotension has been questioned, the simultaneous use with ephedrine appears to improve cardiac output and may promote

cardiovascular stability. In terms of crystalloid preloading, a 10 mL/kg bolus of lactated Ringers immediately prior to the administration of spinal anesthesia appears to have the greatest effect, as larger amounts have been observed to have no additional effect on maternal hemodynamics or ephedrine requirements in a similar population. In addition, although left uterine displacement alone does not prevent hypotension, it has been demonstrated to reduce the incidence of maternal hypotension and improve neonatal blood gas and Apgar evaluations.

References:

1. Rout C, Rocke DA. Spinal hypotension associated with cesarean section: will preload ever work? *Anesthesiology* 1999;91:1565-7.
2. Wennberg E, Frid I, Halijamae H, Noren H. Colloid (3% Dextran 70) with or without ephedrine infusion for cardiovascular stability during extradural caesarean section. *Br J Anaesth* 1992;69:13-8.
3. Park GE, Hauch MA, Curlin F, Datta S, and Bader AM. The effects of varying volumes of crystalloid administration before cesarean delivery on maternal hemodynamics and colloid osmotic pressure. *Anesth Analg* 1996;83:299-303.

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Question: Monday October 8

Is the presence of squamous or trophoblastic cells in the maternal circulation pathognomonic for AFE (amniotic fluid embolism)?

Answer:

No. The presence of squamous or trophoblastic cells does not necessarily indicate that an AFE has occurred. In several studies of pregnant and non-pregnant patients undergoing PA catheterization, squamous cells routinely appear in pulmonary circulation. These cells are most likely the result of contamination by cells at the catheter entry site or exogenous sources during the specimen preparation in the clinical lab. In terms of trophoblastic cells, these cells normally float freely in the intervillous space, and thus have direct access to the maternal circulation. As such, their presence has been frequently noted in maternal circulation without other elements or signs of an AFE.

References:

1. Masson RG. Amniotic fluid embolism. *Clin Chest Med.* 1992;13(4):657-65.
2. Lee W, Ginsburg KA, Cotton DB, Kaufman RH. Squamous and trophoblastic cells in the maternal pulmonary circulation identified by invasive hemodynamic monitoring during the peripartum period. *Am J Obstet Gynecol.* 1986;155(5):999-1001.

Question: Friday, October 5

What are the variables shifting the oxyhemoglobin dissociation curve to the right?

Answer:

A right shifted oxyhemoglobin dissociation curve implies lower affinity, thus lower saturation but may permit lower tissue perfusion. The following variables shift the curve to the right:

1. low pH
 2. high temperature
 3. high 2,3, DPG
 4. high CO₂
 5. pregnancy
 6. sickle cell disease
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Question: Thursday, October 4

How much nitrous oxide is available in the cylinder when the pressure N₂O gauge reads 745 PSI?

Answer:

It is not possible to estimate the amount of N₂O available by measuring the pressure. The pressure in a cylinder containing a liquefied gas such as N₂O (or CO₂ and cyclopropane) depends on VAPOR pressure of the liquid gas and does not indicate the amount of liquefied gas remaining in the cylinder.

The N₂O left in the cylinder can be found out only by weighting it. Tare weight is the weight of an empty cylinder and when subtracted from the total weight of the cylinder gives the weight of the N₂O in the cylinder.

Question: Wednesday October 3

What does a dibucaine number of 80 represent?

Answer:

The dibucaine number, which is the percentage of inhibition of the enzyme activity by dibucaine, thus reflects the quality of the plasma cholinesterase enzyme in its ability to hydrolyze succinylcholine. As such, an individual with plasma cholinesterase of the homozygous typical type should have a dibucaine number of about 80, reflecting normal response to succinylcholine (greatest inhibition). An individual with plasma cholinesterase of the heterozygous type should have a dibucaine number of about 40-60, reflecting slightly prolonged response to succinylcholine. While an individual with

plasma cholinesterase of the homozygous atypical type may have a dibucaine number of about 20, reflecting markedly prolonged response to succinylcholine.

Question: Tuesday, October 02

If a patient is allergic to protamine, how should heparin be antagonized?

Answer:

As adverse and allergic reactions can occur to protamine, alternative methods can be utilized to antagonize heparin including:

- pretreatment of histamine receptor antagonists to limit the allergic response
- avoidance of protamine and allowing heparin to dissipate spontaneously
- administration of hexadimethrine, a heparin antagonist
- administration of heparinase or platelet factor IV
- use of a heparin removal device (HRD)

As pretreatment may not eliminate the sequelae of an allergic reaction and spontaneous resolution of heparin may take hours, the last three methods have generated interest. Hexadimethrine has been used principally outside the United States since the 1950's, although its use has been limited by the marked hemodynamic and inherent anticoagulant derangements that have been noted to occur with its use. Heparinase and platelet factor IV remain principally investigational, and are not widely available.

Most recently, the heparin removal device, which is an extracorporeal circuit that allows ex-vivo deheparinization by mean of a polycationic ligand that binds heparin molecules, has been utilized successfully. As this device does not involve additional medications or blood replacement products (to which allergic reactions or other side effects may occur), further testing is warranted.

References:

1. Cooney A, Mann TJ. Recent experiences with hexadimethrine for neutralizing heparin after cardiopulmonary bypass. *Anaesth Intensive Care* 1999;27(3):298-300.
2. Jegger D, Tevaerai HT, Horisberger J, et al. Assembly of the Heparin Removal Device for patients with suspected adverse reaction to protamine sulphate. *Perfusion* 2000;15(5):453-6.
3. www.theanswerpage.com

Question: Monday, October 1

You are scheduled to provide the anesthetic management to 51years old woman with 3 vessels CAD and severe mitral regurgitation scheduled for CABG and MVR. Coexisting

medical conditions include type II diabetes mellitus, peripheral vascular disease, and depression. In addition, the patient reported 3 TIAs and 4 spontaneous abortions. Laboratory evaluation is unremarkable with the exception of an elevated aPTT and anticardiolipin immunoglobulin M. Antinuclear antibody and lupus anticoagulant panel results are positive. How will you monitor the effectiveness of anticoagulation with Heparin while on CPB for this patient?

Answer:

Monitoring anticoagulation in patients with antiphospholipid syndrome (APL) is challenging. The optimal method for assuring adequate anticoagulation in APL syndrome during CPB is not standardized. APL antibodies often interfere with in vitro tests of hemostasis by impeding the anchoring of coagulation proteins to phospholipids surfaces. The potential of APL antibodies to interfere with ACT requires preoperative confirmatory testing to verify that ACT is unaffected before instituting this form of monitoring. In literature, there were reports when ACT values greater than 999 seconds were chosen empirically, as the adequate endpoint of adequate anticoagulation. Another report measured Heparin plasma level of 2-3 U/ml during CPB as the point of care. Anti Xa monitoring is considered "gold standard" laboratory measure of heparin therapy in which the aPTT (or ACT) can be adversely affected.

References:

1. Shiekh F, et al. Recognition and management of patients with antiphospholipids syndrome undergoing cardiac surgery. *J Cardiothor Vasc Anesth* 1997; 11, 764-766
2. Ducart Ar et al. Management of anticoagulation during cardiopulmonary bypass in a patient with circulating lupus anticoagulant. *J Cardiothor Vasc Anesth* 1997; 11, 878-879.
3. East C, et al. Antiphospholipid syndrome and cardiac surgery: management of anticoagulation in two patients. *Anesth Anal* 2000; 90: 1098-1101.