Pathophysiology and Management of Angiotensin-Converting Enzyme (ACE) Inhibitor–Associated Refractory Hypotension During the Perioperative Period

1. All of the following are true regarding the baroreceptor reflex EXCEPT:
   a. Regulated by receptors found in the aortic arch and carotid sinus
   b. Most effective mechanism in long-term regulation of blood pressure
   c. Blunted by the use of volatile agents
   d. Modulation of neural impulses sent to vasomotor center

2. Which of the following hormones is released from the posterior pituitary gland?
   a. Norepinephrine
   b. Epinephrine
   c. Antidiuretic hormone
   d. Angiotensin II

3. All of the following are therapeutic effects of angiotensin converting enzyme (ACE) inhibitors EXCEPT:
   a. Decreased fluid retention
   b. Enhanced myocardial remodeling
   c. Inhibition of left ventricular hypertrophy
   d. Decreased platelet aggregation

4. What is the most common side effect of ACE inhibitors?
   a. Dry cough
   b. Angioedema
   c. Altered taste
   d. Renal impairment

5. Post-induction ACE inhibitor–associated refractory hypotension is best described by which of the following statements? (CHOOSE TWO.)
   a. Thirty minutes post induction the incidence of hypotension is similar whether ACE inhibitors were continued or withheld preoperatively.
   b. Occasionally post-induction ACE inhibitor associated refractory hypotension may not respond to fluid bolus, ephedrine, and phenylephrine.
   c. Post-induction hypotension is LESS likely to occur when antihypertensives from multiple drug classes are continued preoperatively.
   d. It is necessary to discontinue the use of ACE inhibitors 48 hours prior to surgery to prevent hypotension.

6. All of the following are endogenous vasopressor systems EXCEPT:
   a. Vasopressin system
   b. Sympathetic nervous system
   c. Neural reflex system
   d. Renin-angiotensin-aldosterone system

7. Vasoplegic syndrome is a form of _______ shock that is ________ to treatment with fluids and vasopressors.
   a. Cardiogenic; refractory
   b. Vasodilatory; refractory
   c. Vasodilatory; responsive
   d. Septic; responsive

8. All of the following have been shown to contribute to the development of vasoplegic syndrome EXCEPT:
   a. Preoperative administration of subcutaneous heparin
   b. Poor left ventricular function
   c. Preoperative administration of ACE inhibitors
   d. Prolonged cardiopulmonary bypass time

9. Which of the following statements regarding vasopressin is FALSE?
   a. Vasopressin has a plasma half-life of 4 to 20 minutes.
   b. Side effects of vasopressin are dose-dependent.
   c. Terlipressin is a vasopressin agonist that is available for use in the United States.
   d. A low-dose infusion of vasopressin can be used post cardiopulmonary bypass to improve hemodynamics.

10. Which of the following statements regarding methylene blue is TRUE?
    a. Inaccurately ELEVATED pulse oximeter values are observed with methylene blue administration.
b. Preoperatively administered methylene blue is NOT effective in the prevention of post-induction ACE inhibitor–associated refractory hypotension.
c. The mechanism of action for methylene blue involves competition with NO for binding sites of adenylate cyclase.
d. A dose of 2 mg/kg of methylene blue has been shown to reverse vasoplegic syndrome.

Mitochondrial Diseases and Anesthesia: A Literature Review of Current Opinions

11. The morphology of the mitochondria includes:
   a. An external membrane where the tricarboxylic acid cycle takes place
   b. The cristae, which are formed by the outer membrane
   c. An outer and inner membrane which create the intermembrane space and the innermost matrix space
   d. Intermembrane space where the 5 complexes of the oxidative phosphorylation system are located

12. The human mitochondrion carries its own DNA and is characterized by:
   a. Maternal inheritance, and its genes encode 22 structural subunits of the tricarboxylic acid cycle
   b. Paternal inheritance with 37 genes that encode 22 tRNAs and 2 rRNAs
   c. Encoding more than 100 structural subunits of the urea cycle
   d. Maternal inheritance and containing 37 genes responsible for the encoding of 13 structural subunits of oxidative phosphorylation complexes.

13. Primary mitochondrial diseases are associated with defects in the:
   a. Oxidative phosphorylation system
   b. Nucleus structure
   c. Phospholipid cell membrane
   d. Mitochondrial protein export

14. Disorders of the oxidative phosphorylation system can originate from mutations in:
   a. DNA encoding nociception pathways
   b. Exclusively in the DNA encoding lipid composition of mitochondrial outer membrane
   c. RNA controlling protein assembly
   d. In the mitochondrial or nuclear DNA

15. The most frequent cause of respiratory chain defect originates on the:
   a. Iron-sulfo protein fraction I
   b. Complex assembly IV
   c. Copper transport IV
   d. Complex IV that catalyzes the electron transfer

16. Some of the clinical manifestations associated with respiratory chain defects are:
   a. Alzheimer disease, Parkinson disease
   b. Endocrine dysfunction, hearing loss
   c. Friedrich ataxia, liver failure
   d. Cancer, diabetes and obesity

17. Which of these therapies is an effective CURE for mitochondrial diseases?
   a. Exercise training
   b. Ketogenic diet
   c. Pharmacological
   d. None

18. Protein Transduction Domain Technology offers a mechanism for:
   a. Delivery of human recombinant proteins inside organelles
   b. Delivery of human DNA inside the nucleus
   c. Epigenetic control of protein destruction
   d. Using nuclear transfer technology to remove mitochondrial DNA

19. Local anesthetics have been found to affect mitochondrial function in several ways, including: (CHOOSE TWO.)
   a. Bupivacaine induces sarcomere disruption
   b. Cocaine increases membrane potential
   c. Ropivacaine blocks electron transfer
   d. Tetracaine alters mitochondrial protein exportation

20. For a patient who presents for a diagnostic muscle biopsy for suspected mitochondrial disease, the BEST anesthetic choice is:
   a. Ketamine and low dose halogenated agents
   b. Total intravenous anesthesia with propofol
   c. A rapid sequence induction with succinylcholine
   d. Any local anesthetic

Tobacco Smoking Using a Waterpipe (Hookah): What You Need to Know

21. What is used to heat the tobacco in a waterpipe?
   a. A match
   b. A candle
   c. Charcoal
   d. Propane

22. What is the second most common form of tobacco use on U.S. college campuses today?
   a. Cigarettes
   b. Waterpipe/hookah
   c. Smokeless tobacco
   d. Electronic cigarettes

23. What percentage of U.S. 12th graders reported using a waterpipe in the past year?
   a. Less than 1%
   b. More than 1% but less than 10%
   c. More than 10% but less than 20%
   d. More than 20%
24. On average, about how much smoke is inhaled during a typical waterpipe use episode?
   a. ½ liter
   b. 1.0 liter
   c. 10 liters
   d. 50 or more liters

25. Which toxicants are found in waterpipe tobacco smoke?
   a. Polycyclic aromatic hydrocarbons that cause cancer
   b. Volatile aldehydes that cause lung disease
   c. Nicotine that causes dependence
   d. All of the above

26. When waterpipe tobacco smokers are considered, what are some of the smoke toxicants that have been found in them (ie, in breath and blood)?
   a. Carbon monoxide
   b. Nicotine
   c. Both a and b
   d. Neither a nor b

27. What is one of the reported health risks of waterpipe tobacco smoking?
   a. Carbon monoxide intoxication
   b. Increased facial skin lesions
   c. Tracheal stenosis
   d. Pneumothorax

28. In a patient who engages in regular waterpipe tobacco use the nurse anesthetist should suspect:
   a. Abnormal levels of liver enzymes
   b. Elevated levels of carboxyhemoglobin
   c. Pulmonary function tests indicating a restrictive defect
   d. Difficult airway management

29. What additional test should be considered for a hookah smoker prior to surgery?
   a. Plasma nicotine concentration
   b. Blood aldehyde level
   c. Carboxyhemoglobin level
   d. Nitrosamine concentration

30. Which of the following anesthesia monitors might give an erroneous reading in regular and frequent users of waterpipe tobacco smoking?
   a. Electrocardiogram
   b. Blood pressure
   c. Pulse oximeter
   d. End tidal CO₂

31. Indications for transcatheter aortic valve replacement (TAVR) include:
   a. Aortic valve area of 2.0 cm² and mitral insufficiency
   b. A congenitally bicuspid aortic valve with area of 1.5 cm²
   c. Moderate aortic stenosis and stable chronic obstructive lung disease
   d. Aortic valve area < 1.0 cm² and co-morbidities associated with high-risk surgery

32. All of the following findings in a patient’s medical history are CONTRAINDICATIONS to TAVR EXCEPT:
   a. Angina, syncope, and heart failure
   b. Coronary artery disease requiring surgery
   c. Severe pulmonary hypertension
   d. Extreme frailty with a life expectancy less than a year

33. TAVR is most appropriately performed in:
   a. A hybrid operating environment in a regional center of excellence
   b. The cardiac catheterization laboratory of a community hospital
   c. A large operating room at a teaching facility
   d. Interventional radiology at a major medical center

34. The preferred access route for TAVR is:
   a. Antegrade transapical
   b. Retrograde transfemoral
   c. Retrograde transaxillary
   d. Antegrade transaortic

35. What is the most commonly reported complication from TAVR?
   a. Myocardial injury and mitral regurgitation
   b. Valve embolization
   c. Vascular injury
   d. Stroke

36. How is cardiac ejection interrupted during TAVR to allow for prosthesis implantation?
   a. Cardiopulmonary bypass is instituted.
   b. A balloon is inflated in the aorta to temporarily block flow.
   c. Adenosine is administered to produce a short period of asystole.
   d. The right ventricle is rapidly paced at a rate of 200±20 beats per minute.

37. What dysrhythmia can occur following placement of a transcatheter heart valve that occasionally results in the need for permanent pacing?
   a. Atrial fibrillation
   b. Ventricular fibrillation
   c. Mobitz I atrioventricular block
   d. Complete heart block

38. The most common complication from an improperly sized or positioned transcatheter heart valve is:
   a. Central aortic insufficiency
   b. Paravalvular leak
   c. Coronary occlusion
   d. Valve embolization
39. What anesthetic technique is most commonly utilized in the United States for TAVR via the transfemoral approach?
   a. General endotracheal with a goal of early extubation
   b. General endotracheal with postoperative sedation until stabilized
   c. Regional with light sedation
   d. Local with heavy sedation

40. During the TAVR procedure, hypotension associated with rapid ventricular pacing can be ameliorated by:
   a. Rapid infusion of 1 liter of fluid
   b. Vascular cross-clamping
   c. Administration of a preemptive vasopressor
   d. Hyperventilation of the lungs

41. The vascular glycocalyx is located:
   a. In the lining of the vascular lumen on top of the epithelial cells
   b. On the external surface of the blood vessels
   c. Inside the endothelial cells that make up the blood vessels
   d. Only in the brain and spinal cord

42. The protein and carbohydrate constituents of the glycocalyx are able to bind water up to how many times their own weight?
   a. 10 times
   b. 100 times
   c. 1000 times
   d. 10,000 times

43. A major function of the glycocalyx is:
   a. Promoting the production of red blood cells
   b. Thermoregulation
   c. Maintaining vascular homeostasis
   d. Regulating insulin release

44. The mechano-transduction role of the glycocalyx is most closely associated with which of the following?
   a. Stress response and epinephrine release
   b. Shear forces and nitric oxide release
   c. Metabolic response and glucagon release
   d. Tissue oxygen tension and 2,3 DPG generation

45. The anti-thrombotic effect of the glycocalyx is likely related to its ability to bind ("docking") with:
   a. Antithrombin-III, heparin co-factor II, tissue factor pathway inhibitor
   b. Platelets, fibrinogen
   c. Platelets, thrombin
   d. Plasminogen, glucagon

46. The role of the glycocalyx as a critical determinant of vascular permeability, modifying our thinking about the Starling principle, is primarily related to its:
   a. Effect on the autonomic nervous system’s input into vascular tone
   b. Action on creating a very high extravascular hydrostatic pressure
   c. Acting as an active barrier interface between the plasma and the capillary (endothelial) wall
   d. Action in lowering the plasma colloidal pressure

47. “Shedding” with respect to the glycocalyx, is most closely associated with:
   a. Loss of glycocalyx constituents
   b. Building glycocalyx strength and integrity as erythrocytes shed their cell walls
   c. Plasma proteins accumulation within the glycocalyx increasing its thickness
   d. Recirculation of plasma proteins in and out of the glycocalyx

48. Which of the following are known to be destructive/degrading to the vascular glycocalyx?
   a. Ischemia
   b. Inflammation, trauma, atherosclerosis
   c. Diabetes and hyperglycemia
   d. All of the above

49. A clinical “threat” to the glycocalyx is iatrogenic over-hydration leading to hypervolemia. This is most likely related to the release of:
   a. Vasopressin
   b. Growth hormone
   c. Atrial natriuretic peptide
   d. Oxytocin

50. Available and possible clinical interventions designed to protect the glycocalyx involve which of the following?
   a. Avoiding hypervolemia and ensuring sufficient concentration of natural plasma protein
   b. Development of target drugs that inhibit glycocalyx degradation
   c. Use of steroids, especially hydrocortisone, to prevent shedding
   d. All of the above

Transversus Abdominis Plane (TAP) Blocks

51. The desirable outcomes associated with multimodal analgesia include:
   (CHOOSE TWO.)
   a. Patient satisfaction
   b. Reduction in blood loss
   c. Decreased immune cell activity
   d. Return to daily activities
52. The transversus abdominis plane (TAP) is a neurofascial plane located between which two abdominal muscles?
   a. External oblique and internal oblique
   b. Internal oblique and transversus abdominis
   c. External oblique and transversus abdominis
   d. Rectus abdominis and internal oblique

c. Dexamethasone prolongs the duration of the local anesthetic.
d. The onset of the sensory block is relatively fast.

57. TAP blocks provide analgesia by blocking all of the following EXCEPT:
   a. Intercostal nerves T7-T11
   b. Ilioinguinal and iliohypogastric nerves L1
   c. Subcostal nerve T12
   d. Sacral nerves

53. According to a cadaveric study, characteristics of the triangle of Petit include:
   a. Position varies in size and shape and is more posterior than previously reported.
   b. Position varies in size and shape and is more anterior than previously reported.
   c. Its size and shape is consistent among the specimens in the study.
   d. It is located more cephalad than previously reported.

58. In a study of local anesthetic spread in cadaver models, which of the following approaches had the largest area of spread?
   a. Ilioinguinal-iliohypogastric
   b. Subcostal
   c. Lumbar triangle of Petit (LTOP)
   d. Mid-axillary

59. Which of the following statements is TRUE of TAP blocks?
   a. Somatic and visceral analgesia is provided.
   b. Both sensory and motor blockade of the lower extremities occurs.
   c. Hemodynamic effects are minimal.
   d. TAP blocks are contraindicated in obese patients.

60. Which of the following is TRUE regarding complications associated with TAP blocks?
   a. Complications of TAP blocks are common.
   b. The incidence of local toxicity is high.
   c. Laceration of the liver is possible.
   d. Partial or complete sciatic nerve block can occur inadvertently.