Post-test--ACS Surgical Critical Care Review Course

1. Preeclampsia:
    a. typically occurs in the first trimester of pregnancy
    b. **is associated with post-partum pulmonary edema**
    c. is manifest by renal failure associated with diuresis
    d. is commonly associated with HELLP syndrome

    Rationale: Preeclampsia occurs after the 20 week of pregnancy and is characterized by hypertension (>160/110), edema and proteinuria; when severe, dysfunction of hepatic, renal, cerebral and hematologic symptoms. Blurred vision, headache, CVA, hepatic distension, elevated transaminases, nausea and vomiting, drop in platelet counts, DIC, pulmonary edema and encephalopathy; renal failure is typically oliguric. HELLP syndrome occurs in 2-12% of the time. Pulmonary edema complicates 3% of preeclampsia and usually occurs postpartum.

2. Which statement regarding ethics in the care of critically ill children is true?:
    a. Parents can withhold medical treatment if it is against their religious beliefs
    b. End of life care should be directed at pain control as long as the treatment does not compromise the child's ability to maintain an airway
    c. A 10 year old child should assent to care
    d. A 10 year old child should consent to care

    Rationale: Around the age of 7 years, children develop an increasing capacity to understand, process, and make decisions about their care. The American Academy of Pediatrics has stated, "Patients should participate in decision-making commensurate with their development; they should provide assent to care whenever reasonable."

3. Which of the following are true concerning CNS infections?:

    a. Steroids should not be administered in the setting of bacterial meningitis due to an increased risk of secondary infections
    b. Viral meningitis should be empirically treated with acyclovir
    c. Brain biopsy is needed for diagnosis of viral encephalitis
    d. Surgical treatment of brain abscess is recommended in combination with antibiotics as initial therapy for a cerebellar abscess of 2cm

    Rationale: Current recommendations in adults include the use of dexamethasone to prevent the sequelae of bacterial lysis. Viral *encephalitis* should be empirically treated with acyclovir. No specific pharmacological treatment is needed for viral meningitis. Brain biopsies are indicated in the setting of viral encephalitis only if the clinical presentation is atypical, PCR analysis of the CSF is negative, or there is significant clinical deterioration despite treatment. Surgical drainage is indicated for large (>3 cm), superficial, or cerebellar abscesses.

4. The optimal modality for clearance of the cervical spine in patients who do not meet the NEXUS low risk criteria for clinical clearance is:

a. CT
b. Plain radiographs, 3 view series
c. MRI
d. Flexion Extension dynamic fluoroscopy

Rationale: For patients requiring imaging to clear their cervical spine, CT has superior sensitivity when compared to plain radiographs. Dynamic flexion extension testing is not utilized for routine screening purposes and the addition of MRI, even in the obtunded multi-system trauma patient has not been demonstrated to increase the diagnostic yield of clinically significant injuries when compared to CT.

5. Which of the following statements regarding resuscitation is true?:

a. Resuscitation for TBI patients should begin with a 500 mL bolus of 7.5% Hypertonic Saline with Dextran
b. Prior to the infusion of blood, a 250 mL challenge of 5% Albumin should be initiated
c. Aggressive ratios of Plasma and Platelets approaching 1:1:1 have been associated with improved mortality in patients undergoing a massive transfusion
d. All patients undergoing a massive transfusion should receive a standard dose of 100 mcg/kg of recombinant Factor VIIa

Rationale: The parallel ROC hypertonic saline trials showed now benefit in the hypovolemic shock or TBI patient subsets. There is no role for albumin in the acute resuscitation of the injured patient. Likewise, the CONTROL trial has demonstrated that there is no survival benefit to the routine use of Factor VIIa in trauma patients.

6. A 64 year old male with no significant past medical history who is intubated the ICU following an emergency exploratory laparotomy for perforated diverticulitis has a single generalized tonic-clonic seizure lasting <2 minutes. He is now 1 hour after the seizure and remains unresponsive. He is afebrile and hemodynamically stable. Which if the following should be done next?:

a. Administration of 2mg of IV lorazepam
b. EEG
c. Dilantin load with 15 mg/kg to 20 mg/kg
d. 1 amp sodium bicarbonate to alkalize the urine

Rationale: A STAT EEG should be obtained in all patients with an abnormal mental status after a generalized convulsive seizure to rule out nonconvulsive status epilepticus. Single self-limited seizures rarely require therapy other than to treat the underlying cause. Although rhabdomyolysis is known to occur after seizures, this typically is seen in patients with recurrent seizures or convulsive status epilepticus. First line therapy for rhabdomyolysis would be aggressive hydration.

7. A 55 year-old woman is intubated in the intensive care unit 6 days after a low anterior resection for rectal cancer due to sepsis secondary to a urinary tract infection. She is responding to appropriate antibiotics and her pressor requirements have decreased. Her BMI is 38. What is her caloric goal (per ideal body weight)?:

a. 15 kcal/kg/day
b. 20 kcal/kg/day
c. 25 kcal/kg/day
d. 30 kcal/kg/day

Rationale: The standard recommendation for critically ill patients is to receive 25-30 kcal/kg/day. For bariatric patients, hypocaloric feeding is recommended, 11-14 kcal/kg/day. However, when using their ideal body weight, this equates to a recommendation of 22-25 kcal/kg/day.

8. Intermittent hemodialysis:
a. Establishes an effective creatinine clearance of 50 ml/min
b. Evidences more complications that continuous techniques
c. Is appropriate for patients with pressor-requiring shock patients
d. Has outcomes similar to continuous dialysis in non-shock patients

Rationale: In patients who are able to tolerate either intermittent (IHD) or continuous renal replacement therapy (CRRT) outcomes are indeed equivalent. CRRT still is the dialysis modality of choice for those with hemodynamic instability. IHD and CRRT establish an effective creatinine clearance of ~ 25 ml/min and allows for pharmacologic dosing at that level of renal function. IHD does not have more complications and generally costs less than CRRT. CRRT generally is more complicated due to issues with filter clotting, temporary access, catheter-related infection and sepsis, and other resource consuming complications.

9. When should antiseptic or antibiotic impregnated central venous catheters be placed?:
a. They are never cost effective and should never be placed
b. When infection rate is >5.5/1000 catheter days
c. When infection rates are above goal rates in after implementing a comprehensive strategy to reduce CLABSI
d. When infection rates are above the NHSN national average as reported by the CDC

Rationale: The first line effort to decrease CLABSI should be instituting a comprehensive strategy which includes a) educating providers who insert and maintain catheters, b) use of maximal sterile barrier precautions, and c) using a chlorhexidine prep during central venous catheter insertion. There is extensive data that such an approach can markedly reduce CLABSI rates as low as 0, over an extended follow-up period. If this is not successful, antiseptic or antibiotic-impregnated catheters have been shown to reduce CLABSI rates without increasing long-term resistance. This should be thought of as an adjunctive strategy when primary efforts are unsuccessful in getting your ICU down to goal rates set by your institution.

10. The greatest risk factor for development of ventilator associated pneumonia in surgical patients is:

    a. Polytrauma
    b. Alcohol abuse
    c. Duration of mechanical ventilation
    d. Burn

    Rationale: A recent multivariate analysis identified several risk factors that led to an increased risk of postoperative pneumonia, including type of surgery, age, functional status, recent weight loss, chronic obstructive pulmonary disease (COPD), type of anesthesia, impaired sensorium, history of a cerebrovascular accident, blood urea nitrogen (BUN) level, substantial transfusion, emergency surgical intervention, long-term steroid use, recent smoking, and significant recent alcohol use. In addition, surgical patients are much more likely to develop ventilator associated pneumonia, including 10-20% of patients who are the victims of inhalation injury. The single greatest risk factor for ventilator associated pneumonia, however, is the duration of mechanical ventilation. The risk peaks at day 5 on the ventilator, plateaus after day 15, and then declines significantly.

11. Which of the following immunosupplements causes harm to patients with severe sepsis?

    a. Glutamine
    b. Arginine
    c. Selenium
    d. Chromium

    Rationale: Selenium and chromium have not been shown to cause harm to any specific subpopulation of critically ill patients. Glutamine is not currently recommended for patients with severe sepsis by any of the three major nutrition societies, but it is not known to cause harm. Arginine may benefit trauma and burn patients, and may benefit patients with mild or moderate sepsis, but is associated with harm in patients with severe sepsis. This is thought to be due to an actual increase in arginine that occurs during sepsis, so that supplementation is not only superfluous, but actually harmful.

12. The most effective route of preventing pneumonia in a ventilated patient is:

    a. Feeding post-operative patients into the small intestine
    b. Positioning the patient with the head of the bed up at 30-45 degrees
    c. Routinely changing ventilator circuits and using single-use catheter suction systems
    d. Selective decontamination of the digestive tract (SDD)

Rationale: Positioning patients in a supine position markedly increases the risk of ventilator associated pneumonia. As such, unless a specific contraindication exists, all patients should be positioned with the head of the bed at least 30-45 degrees up. There is no convincing benefit to feeding a patient in the stomach or small intestine. Routinely changing ventilator circuits does not prevent ventilator associated pneumonia. The incidence of pneumonia is similar regardless of whether a single-use catheter system or closed multi-use catheter system is used for suctioning. The use of SDD is controversial. There are large-scale trials showing a small in mortality and a large decrease in gram negative pneumonia when following this protocol. However, due to concerns about breeding resistant organisms, SDD is not commonly used in the United States and is not recommended in most guidelines for pneumonia prevention.

13 . A 57 year-old male develops rapid atrial fibrillation on post-op day 3 following a cadaveric renal transplant. His urine output has been appropriate post-op and he has received adequate resuscitative fluids. He is started and maintained on Diltiazem which is able to control his rate. Over the next four days, the patient's urine output begins to drop and the patient's creatinine begins to rise. Accompanying this are hyperkalemia, transaminitis, and confusion. His heart rate and blood pressure remain normal. His medications include: Tacrolimus, Mycophenolate mofetil, prednisone, nephrocaps, insulin, bisacodyl, and hydrocodone/5cetaminophen. Which of the following will aid the most in making the diagnosis?:

a. Check a Tacrolimus level
b. Obtain a CT Scan
c. Obtain peripheral blood cultures, urine cultures, and start broad-spectrum antibiotics
d. Discontinue pain medication and follow laboratory values

Rationale: Diagnosis: Diltiazem leading to calcineurin toxicity. Calcineurin inhibitors (i.e. Tacrolimus and Cyclosporine) are both metabolized in the liver via the cytochrome P450-3A4 pathway. There are several medications that can inhibit this pathway and thus cause elevations in calcineurin inhibitor levels leading to signs and symptoms of toxicity. Some of these medications include azole antifungals, erythromycin, clarithromycin, amiodarone, and the non-dihydropyridine calcium channel blockers: Verapamil and Diltiazem. With the patient receiving ongoing Diltiazem via an intravenous route in combination with Tacrolimus, he developed the classic signs and symptoms of calcineurin toxicity as described. Treatment is to discontinue the Diltiazem infusion and hold further doses of tacrolimus until normal therapeutic levels have been achieved.

14. Which of the following statements best describes the outcome from acute renal failure occurring in the ICU?:

a. Outcome is primarily driven by the rapidity of renal recovery
b. Population-based in-hospital mortality rates are approximately 50%
c. If patients survive to ICU discharge, life expectancy is normal
d. Improved outcomes occur in patients managed with diuretics

Rationale: New-onset ARF in the ICU has a durable mortality of ~ 50% across multiple studies and spanning the last decade of inquiry. The rapidity of recovery does not relate to outcome, and may be reduced when diuretics are used to manage volume status as opposed to dialytic techniques. Life expectancy is reduced and may approach 70% mortality by 7 years post-ICU ARF onset.

15. You are the first physician to arrive on the scene of a "code." The patient is a frail elderly looking man who is unconscious and in asystole. The chart is not immediately available. What is the most reasonable course of action?:

a. Ask for the chart to verify code status.
b. Spend a moment trying to verify code status then institute ACLS protocol.
c. Immediately begin ACLS protocol without verification of code status.
d. Verify asystole and pronounce death.

Rationale: Verification of a patient's wishes regarding their treatment is critical. The majority of deaths (>90%) in the hospital are related to limitations in treatment. Hopefully in this frail elderly patient his code status has been addressed prior to his arrest. Verification of code status prior to institution of ACLS is appropriate.

16. Starch-based colloid plasma volume expansion is:

a. Three times as effective as crystalloid resuscitation
b. Unassociated with coagulation abnormalities
c. Linked to AKI and ARF in septic shock patients
d. Appropriate to use without maintenance fluid

Rationale: In multiple studies of ICU patients receiving starch compared to crystalloid resuscitation, the actual ratio of starch to crystalloid with regard to bioequivalent resuscitation efficacy is 1:1.4 and not the expected 1:3. Starch based resuscitation does impede the coagulation system, and is frequently related to diminished calcium and magnesium in the diluent. Increasing data does link starch resuscitation to AKI and ARF in patients with severe sepsis and septic shock, although such a link has not been well-established in other conditions. Maintenance fluid is required as starch preparation do not provide free water in significant quantity and as such will create a hyperoncotic state which is strongly associated with AKI and ARF.

17. A 55 year old female returns to the Emergency Department for uterine bleeding, abdominal pain and mental status changes a week after a dilatation and curettage. The heart rate is 150 bpm in atrial fibrillation. The systolic blood pressure is 60 mm Hg. Crystalloid infusion is started through a central line; the CVP is 6 mm Hg. Echocardiography shows a flat IVC and hyperdynamic heart with a minimal pericardial effusion. The most likely reason for the hypotension is:

a. Hypovolemia

b. Left ventricular dysfunction
c. Tamponade
d. Pulmonary embolism

Rationale: Inferior vena cava (IVC) diameter and collapsibility has been shown to be a reliable method of monitoring intravascular volume in mechanically ventilated patients, patients in septic shock, and also in patients not ventilated receiving dialysis In addition to this visualization of an empty hyperdynamic heart is an indicator of hypovolemia.

18. The patient in the question above is taken emergently to the operating room where a bowel perforation is found with gross abdominal contamination. She receives 5 L of crystalloid and a unit of packed red blood cells. Her urine output during the case is minimal. Intra- operatively she had an arterial line placed with a FloTrac Vigileo ™ showing a CO of 5 L/min and a stroke volume variation of 33 mL/beat. CVP now is 15.

She arrives to the ICU intubated and has a new episode of hypotension. Her hemodynamic parameters are as follows: CO 2.5L/min SVV 7mL/beat CVP 22 mm Hg and systolic blood pressure of 80mm Hg. Echo shows a full IVC with mild dilation of the right atrium, sluggish global heart contraction and no pericardial effusion. Your diagnosis is most likely:

a. Persistent Hypovolemia
b. Pulmonary Embolism
c. Impossible to tell needs a pulmonary artery catheter to diagnose
d. Sepsis induced cardiac dysfunction

Rationale: In the septic patient, bedside echocardiography is valuable for identification of the cause of hemodynamic instability (which may be of hypovolemic, cardiogenic, or distributive origin) and for the subsequent optimization of therapy (i.e., fluid administration, inotropic or pressor infusion, or a combination of the above).

19. A patient with acute respiratory distress syndrome and a PaO2/FIO2 ratio of 150 is turned from the supine position to the prone position, with no change in ventilator settings. The PaO2/FIO2 ratio an hour later is 185. The improved oxygenation is due to all of the following except:

a. decreased anatomic shunt
b. decreased alveolar-arterial gradient
c. decreased V/Q mismatch in zone 3 of the lungs
d. decreased transpulmonary shunt

Rationale: In ARDS, the dependent portions of the lungs experience consolidation and alveolar collapse secondary to noncardiogenic edema, inflammation, decreased clearance of secretions, and compression from the weight of the more anterior lung tissue. This results in well perfused but poorly ventilated posterior lung fields (zone 3). As a result, gas exchange between zone 3 alveoli and blood from the pulmonary arteries is poor, and this oxygen-poor blood is mixed with

oxygenated blood from better ventilated lung segments, lowering the overall PaO2 in the systemic circulation. The term shunt describes the flow of suboptimally oxygenated blood to the left side of the heart. The intra- or transpulmonary shunt refers to blood that passes through the capillaries of poorly ventilated or nonventilated alveoli, while the anatomic shunt refers to blood that perfuses the bronchial tree itself and vessels that empty directly into the left heart without passing through the pulmonary arterial circulation (thebesian veins). The anatomic shunt is fairly constant, and cannot be clinically manipulated to improve oxygen content. The transpulmonary shunt, if not a complete shunt (that is, there is some degree of ventilation) can be improved by inspiration of 100% oxygen, or by improving the matching of ventilation and perfusion in the lung itself. In ARDS patients, when the poorly ventilated posterior lung segments are put in the anterior position by proning, these areas are then better ventilated and oxygen exchange is improved. Likewise, the previously anterior segments that were not consolidated are exposed to improved blood flow when changed to a posterior position. Both anterior and posterior segments experience a decrease in their degree of ventilation/perfusion mismatch, and with improved oxygen exchange, the difference between the pO2 in the alveoli and the capillaries decreases (i.e. the pO2 of blood leaving the capillaries increases). With time however, the newly dependent lung fields may become consolidated themselves, worsening the shunt.

20. Which of the following anticoagulants is not indicated in the treatment of venous thromboembolism (VTE) once a diagnosis of heparin-induced thrombocytopenia is established:

A. Lepirudin
B. Argatroban
C. Fondaparinux
D. Dalteparin

Rationale: Heparin-induced thrombocytopenia (HIT) and heparin-induced thrombocytopenia with thrombosis (HITTS) may develop in 1-5% of patients exposed to heparin products, typically between 3 and 14 days after exposure, although may be sooner in patients with previous exposure. Heparin-induced thrombocytopenia should be suspected when there is a 50% or more decrease in the platelet count, the platelet count drops below 100,000 cells/microL, or thrombosis is noted during anticoagulation. Nonimmune- (HIT) and immune-mediated (HITTS) processes are described, the latter in which heparin-dependent antibody binds to platelet factor 4 forming a heparin-PF4-antibody complex. This complex activates platelets causing aggregation and removal from circulation, leading to thrombocytopenia with or without thrombosis. Lepirudin and argatroban are direct thrombin inhibitors and do not bind to platelet factor 4. Both lepirudin and argatroban are indicated in the treatment of HIT/HITTS. Fondaparinux is a factor Xa inhibitor and also does not bind to platelet factor 4. Recent evidence suggests fondaparinux may be used to treat HIT/HITTS as well. Dalteparin is a low-molecular-weight heparin similar to enoxaparin, and while the incidence of HIT is decreased compared to unfractionated heparin, it is not zero. Therefore, dalteparin is the correct answer.

21. When should parenteral nutrition be used to supplement enteral nutrition?:

a. At the initiation of nutritional supplementation
b. On day 2 of enteral nutrition if caloric goal not met
c. On day 7 of enteral nutrition if caloric goal not met
d. Parenteral nutrition should not be used if enteral nutrition is tolerated, regardless of caloric intake.

Rationale: In general, enteral nutrition is the preferred route for nutritional supplementation. A minimum of 50-65% of total caloric needs should be met by the enteral route in order to provide "enough" nutrition. Early enteral nutrition, within 48 hours, is of greater benefit than delayed enteral nutrition. However, early parenteral nutrition, regardless of caloric goals, is associated with worse outcome. Supplemental parenteral nutrition should be delayed until day 7.

22. Which of the following is true regarding ECMO in adult patients with ARDS?

a. VA-ECMO is associated with decreased mortality compared to VV-ECMO
b. Anticoagulation is required but is not associated with increased complications
c. Transfer to a specialized center with ECMO capabilities is associated with decreased mortality
d. ECMO is contraindicated after ≥ 5 days of mechanical ventilation

Rationale: The CESAR trial randomized 180 ARDS patients to best conventional expert treatment versus transfer to a specialized center with ECMO capabilities; significant reduction of six-month mortality was seen in the specialized center group. VV-ECMO is the preferred mode for support of acute respiratory failure. Bleeding events are responsible for the most serious complications on ECMO. ECMO support is most commonly considered within seven days of initiating mechanical ventilation, however, successful support is feasible after the initial time window.

23. What is the optimal timing for tracheostomy in patients with acute respiratory failure?:

a. 1-4 days after intubation
b. 4-6 days after intubation
c. 6-8 days after intubation
d. ≥ 10 days after intubation

Rationale: Data from the most recent randomized trial suggests no difference in rates of ventilator-associated pneumonia, length of stay or mortality between early (< 4 days) or later (> 10 days) tracheostomy. Sedation requirements were decreased in the early group and certain populations (i.e., traumatic brain injury, patients requiring repeated operative procedures) may benefit from earlier intervention.

24. The optimal modality for clearance of the cervical spine in patients who do not meet the NEXUS low risk criteria for clinical clearance is:

a. CT
b. Plain radiographs, 3 view series
c. MRI
d. Flexion Extension dynamic fluoroscopy

Rationale: For patients requiring imaging to clear their cervical spine, CT has superior sensitivity when compared to plain radiographs. Dynamic flexion extension testing is not utilized for routine screening purposes and the addition of MRI, even in the obtunded multi-system trauma patient has not been demonstrated to increase the diagnostic yield of clinically significant injuries when compared to CT.

25. A 25 year-old male undergoes a pancreas transplant 4 years after a kidney transplant with normalizing blood sugars post-op. The pancreas was anastomosed to the iliac artery and vein (opposite side to the kidney graft) and had a pancreatico-duodeno-cystostomy. On the night of post-op day 2, the patient describes increasing abdominal pain and is noted to be hyperglycemic to >300. On exam, the patient is hemodynamically normal and has tenderness over the pancreas graft with hematuria. What is the next diagnostic step in managing this patient?:

a. Take the patient to the OR for emergent exploration
b. Obtain a biopsy of the pancreas transplant
c. Obtain a biopsy of the kidney transplant
d. **Obtain an immediate ultrasound of the pancreas transplant**

Rationale: Portal vein thrombosis is a relatively common complication following pancreas transplant where some advocate post-operative low dose anticoagulation to help prevent it. The pathophysiology involved includes slowed blood flow through a freshly anastomosed pancreas graft. The differential diagnosis for this patient may include portal vein thrombosis, acute rejection, localized bleeding and/or leak related complications. To assist in making the diagnosis in a rapid manner, an immediate ultrasound can help distinguish between operatively versus non-operatively managed complications.