Answers:

1. The ICU Experience

1.1. [D]
1.2. [D]
1.3. [B]
1.4. [A] The ACGME has identified 6 areas defined as the "core competencies". They are: Patient Care, Medical Knowledge, Practice-Based Learning and Improvement, Interpersonal and Communication Skills, Professionalism and Systems Based Practice. For more details about this and the Outcome Project (a project to help training programs achieve the competencies), see their website, http://www.acgme.org/outcome/comp/compMin.asp

2. ICU Management

2.1. [C] Open communication with the primary physician is key to avoid conflicts at the time of discharge from the ICU.
2.2. [C] Respiratory therapy and nursing can accelerate weaning base on an established protocol.
2.3. [C] Only C is Correct
2.4. [B] Large nursing ratios worsen outcomes in the ICU.
2.5. [D] The APACHE (Acute Physiology, Age, Chronic Health Evaluation) Scoring system helps to predict patient mortality and helps to compare institutions.

3. Family Support and Ethics Issues

3.1. [E]
3.2. [B]
3.3. [B]
3.4. [C]
3.5. [B]
3.6. [C]

4. Cardiopulmonary Resuscitation (CPR)

4.1. [D] Since all patients in an ICU have continuous ECG monitoring, development of cardiac arrest in this setting should be witnessed. A defibrillator should be immediately available in the ICU. Under such circumstances, defibrillation should be the first intervention and should not be delayed for any other therapy. If it can be applied within one minute of arrest, even basic life support may be unnecessary.
4.2. [D] Using the least necessary energy levels lessens the myocardial damage and arrhythmias that may occur with cardioversion/defibrillation. The maximum energy should be 120 to 200 Joules for biphasic defibrillators and 360 Joules for monophasic defibrillators. Proper synchronization mode selection is necessary to avoid induction of ventricular fibrillation when the countershock falls on the T-wave of the electrocardiogram. The general recommendations for selecting synchronized shocks are as follows: 1) A patient with symptomatic stable tachycardia; 2) A patient with unstable tachycardia with pulses. Otherwise, the asynchronous mode should be selected for delivering shocks to prevent delays in therapy. General recommendation for delivering asynchronous shocks include the following: 1) A patient who is pulseless; 2) An unstable, rapidly deteriorating patient with rapid polymorphic VT, when delay in delivery of the shock is not considered safe; 3) When you are unsure whether monomorphic or polymorphic VT is present in the unstable patient. If VF is induced following an unsynchronized shock, asynchronized defibrillation should be performed immediately.
4.3. [E] Administration of sodium bicarbonate produces carbonic acid which is converted to carbon dioxide. In the setting of cardiac arrest and CPR, cardiac output is known to be severely decreased such that efficient elimination of carbon dioxide is absent, even with adequate ventilation. Therefore, carbon dioxide permeates cell walls and will lead to severe tissue acidosis that will not be reflected in arterial blood gases. Therefore, the AHA recommends

avoiding sodium bicarbonate until successful resuscitation has reestablished a perfusing rhythm. An exception is cardiac arrest secondary to known hyperkalemia.

4.4. [C] The effectiveness of epinephrine during cardiac arrest is entirely related to its alpha-adrenergic stimulating properties of raising vascular resistance, aortic blood pressure, and myocardial and cerebral perfusion pressure during closed chest compressions. Direct stimulation of the myocardium through its beta-adrenergic effects is unnecessary for successful restoration of spontaneous circulation although these effects may be useful in the immediate post-resuscitation period to overcome the global myocardial stunning. There is little evidence that epinephrine improves the success rate or lowers the energy necessary for defibrillation.

4.5. [A] Epinephrine is absorbed through the tracheal mucosa when administered through the endotracheal tube. With an intact circulation, peak blood levels and the time course of physiologic effect are similar to intravenous administration. However, during CPR with markedly reduced pulmonary circulation, peak levels tend to significantly reduce and the time course of effect is delayed and unpredictable.

4.6. [A] There is little evidence that administering calcium salts during CPR will improve resuscitation success. The exceptions include known severe hypocalcemia, severe hyperkalemia, or calcium channel blocker overdose.

5. Transport of the Critically Ill

5.1. [E]
5.2. [B]
5.3. [D]
5.4. [B]
5.5. [B]

6. Sedation of the Critically Ill

6.1. [D] Although midazolam and fentanyl are considered short acting agents, after prolonged infusion, their kinetics change and active metabolites may accumulate, increasing the time to recover. Flumazenil and naloxone can be used to reverse the effects of midazolam and fentanyl; however, they may precipitate acute withdrawal syndromes and cardiovascular catastrophe. Without localizing findings, an organic cause of coma is less likely. Non-convulsive status is an uncommon cause of coma, and even less likely in a patient receiving benzodiazepines.

6.2. [E] Breakthrough pain is common with bolus narcotic administration and may cause agitation. Benzodiazepine withdrawal, which consists of autonomic hyperactivity, usually occurs several days following cessation, but with bolus administration, withdrawal can occur during drug administration. Organic causes for agitation should always be sought. Carbon dioxide accumulation can lead to sympathetic hyperactivity.

6.3. [A] Life-threatening status asthmaticus may respond to inhalational anesthesia when other treatment has failed; however, no controlled studies have determined the superiority of one agent over the other. Halothane is the best studied direct bronchial dilator; however, its cardiac depressive effects limit its use in this circumstance. General anesthesia should be given by a trained individual and scavenging of waste gases should occur. Atmospheric pollution is not generally monitored in the ICU. Renal failure from prolonged use of methoxyflurane was frequent in the past. Renal failure from prolonged use of methoxyflurane was frequent in the past. Elevated fluoride levels may occur with isoflurane; however, renal failure is unlikely.

6.4. [C] Failure to provide effective manual ventilation is common in inexperienced hands due to upper airway obstruction. Foreign bodies can also cause obstruction. Seizures are occasionally seen with narcotic administration, but the rigid chest syndrome is much more likely with a large bolus dose of fentanyl.

6.5. [B] Unlike the benzodiazepines and other sedative drugs, propofol remains a short-acting sedative even after days of infusion. Hypotension frequently follows bolus administration but is rare with continuous infusion. This is believed to be due to vasodilation, although some studies suggest a mild myocardial depressant effect. Since it is a short acting agent, it must be given as an infusion to achieve stable effects. Propofol can be combined with narcotics and the effects are synergistic, often resulting in marked depression of respiratory drive. The cost-effectiveness of propofol depends on the clinical situation and what alternatives are available.

6.6. [E] Safe sedation requires appropriate monitoring, emergency drugs, and equipment. The most important monitor is a trained individual whose only responsibility is to watch the patient. This cannot be the operator, but must be a second individual dedicated to this task and not necessarily an anesthesiologist. It is not mandatory that an ECG be used; however, pulse oximetry is more likely to identify problems. Resuscitation equipment must be available; however, airway equipment is more important than a defibrillator.

7. Analgesia in the ICU

7.1. [B]
7.2. [C]
7.3. [D]
7.4. [B]
7.5. [C]

8. Neuromuscular Blockade

8.1. [B] Phenytoin is associated with resistance. The other drugs are all associated with potentiating the effect of NMB drugs.
8.2. [C] Pipecuronium has long lasting effects
8.3. [D] Hyperkalemia is a potential complication of the depolarizing muscle relaxant, succinylcholine, in certain patients
8.4. [C] There is increasing recognition of prolonged weakness in the ICU associated with the use of NMB drugs. However, this entity is most likely multifactorial with concomitant use of steroids, drug overdose, drug or drug metabolite accumulation, sepsis and other as potential etiologies. Propofol has not been implicated in damaging the neuromuscular junction.
8.5. [A] Although adjustment of the TOF to 2 twitches is recommended while using NMBA, its use is sometimes challenging in the ICU patient due to diaphoresis and edema.

9. Acid-base Balance

9.1. [D] The most common acid-base abnormality associated with salicylate intoxication is a respiratory alkalosis caused by direct stimulation of the medullary respiratory center. A pure metabolic acidosis due to salicylate intoxication is unusual. Even in severe salicylate intoxication, it is more common to see a mixed disorder secondary to the anion gap metabolic acidosis due to both salicylic acid and formation of lactate.
9.2. [C] Winter's formula is used to estimate the expected drop in PaCO2 that occurs as a result of respiratory compensation for a metabolic acidosis. The formula is less accurate for mild acidosis with a bicarbonate level > 20 mmol/L. The formula is as follows:

Expected PaCO2 (mmHg) = [(1.5 x HCO3-) + 8]

9.3. [E] In contrast to acute acidemia, acute alkalemia reduces cerebral blood flow, increases the affinity of oxygen for hemoglobin and increases calcium binding to proteins.
9.4. [E] Depending on the etiology of the acidosis, bicarbonate therapy remains controversial. It is generally acceptable to administer alkali when the pH falls below 7.2 due to a metabolic acidosis to prevent arrhythmias and cardiovascular collapse. However, it may have harmful consequences as listed in the question above and therapy with alkali should be monitored closely.
9.5. [B] The anion gap is the difference between the major cations (Na+ and K+) and major anions (HCO3- and Cl-) which is normally 12 + or – 4 when potassium is included. The difference between these measured ions is typically due to the other normal anions in circulation, mainly albumin and phosphate. To a much lesser extent, sulfates and lactate also contribute to the anion gap, but their contribution is offset by other proteins and ions. Therefore, the anion gap is used to narrow the differential diagnosis of a metabolic acidosis, but is limited in the critically ill patient by changes in albumin and phosphates to the point that it has been recommended that the "normal" range for the anion gap be adjusted for each patient by the following formula:

"adjusted" anion gap = 2 x [albumin(g/dL)] + 0.5 x [phosphate(mg/dL)]

10. Metabolic and Endocrine Abnormalities

10.1. [C] Early goal resuscitation is considered the cornerstone of management of septic patients. Tight glucose control and the use of vasopressin in refractory hypotension despite fluid resuscitation are also recommended strategies. Steroids have been proven to be effective and safe in those individuals that have abnormal response to stimulation test.

10.2. [A] Tight glucose control has been proven to improve mortality in the surgical ICU but not in the medical ICU. (Except in patients staying longer than 3 days). The other options are correct despite the type of ICU.

10.3. [D] Vasopressin improves renal parameters in at least one study and has been proven effective and safe in septic patients for 24 hrs. No myocardial ischemia in up to 24 hrs of treatment has been described and a trial comparing vasopressin vs. norepinephrine is on going. Norepinephrine should still be consider first line in septic patients requiring vasopressors.

10.4. [D] Euthyroid sick syndrome is defined as abnormal TFT's without thyroid disease. There are many presentations with a low T3 being the most common. This particular presentation seems to be caused by decreased conversion from t4 to T3 in the liver.

10.5. [D] CIRCI seems to be multifactorial with deficiencies beyond the adrenal gland itself. It is commonly characterized by hypotension. Steroid replacement appears indicated only in patients who remain pressor dependent despite adequate fluid resuscitation. Etomidate, even at single doses, has been implicated in the development of CIRCI.

11. Fluid Management

11.1. [B]
11.2. [A]
11.3. [D]
11.4. [D]
11.5. [D]

12. Gastrointestinal Bleeding

12.1. [E] The incidence of significant bleeding due to superficial erosive gastritis, or stress gastritis in decreasing. The disease process is well recognized and a high index of suspicion maintained. Improvements in resuscitative techniques with early recognition and aggressive correction of perfusion deficits, use of prophylactic anti-secretory agents, and the early institution of enteral feeds have all contributed towards the observed reduction in incidence. All of the above are therefore true.

12.2. [D] The first step in the management of patients with gastrointestinal bleeding is to institute resuscitative measures. After assessing and securing the airway, IV access is obtained and fluid resuscitation is begun. Failure to respond to isotonic crystalloids necessitates the use of blood products.

12.3. [E] Patients with head injury, burns, and need for steroids and those with liver failure are all are an increased risk of bleeding from the upper gastrointestinal tract. Prophylactic anti-secretory agents are indicated in all these patients. A complicated soft tissue infection by itself does not increase the risk of bleeding

12.4. [A] Failure to respond to conventional measures is an indication for surgical intervention. As the source of the bleed cannot be identified and is presumed by history to be in the lower gastrointestinal tract, a subtotal colectomy must be performed to eliminate the source of bleeding.

12.5. [D] The patient has a Mallory-Weiss tear. It is unlikely to cease spontaneously. Anitemetics and increasing the gastric pH may decrease progression but does not stop the bleeding. EGD with thermal coagulation is the most definitive method for controlling bleeding. Esophagectomy is required in the rare instance that endoscopic treatment fails.

13. Thromboembolic Disease

13.1. [B] The primary goal is full anticoagulation for patients in which a high index of suspicion for PE exists. The diagnostic study chosen will be partly dependent on institutional strengths and rapid availability of any given study.

13.2. [E] A high probability V/Q scan is accepted as evidence of PE in greater than 90% of patients, and no further studies are needed. Exceptions to the above rule would include patients who

have previously experienced a PE and who have not received a V/Q scan or baseline comparison. With low clinical suspicion, only 56% of patients with a high-probability V/Q scan will have a PE. Warfarin therapy should be initiated within 24 hours of the diagnosis of DVT.

13.3. [C] Normal lower extremity studies, of course, don't preclude DVT or PE. Depending on the patient's hemodynamic and pulmonary vasculature response, hypoxemia may or may not be present with clinically significant PE. Hormone replacement is not associated with an increased risk of DVT, although pharmacologic estrogen therapy (i.e., oral contraceptives) is.

14. Bleeding in the ICU

14.1. [C] In any bleeding, the first priority is volume and/or blood replacement followed by investigation of the bleeding causes to establish proper therapy

14.2. [D] Hemophilia A or Factor VIII deficiency is a sex-linked recessive disease occurring in the U.S.A. with an incidence of 1 in 5,000 to 10,000 males. Anti-thrombin III deficiency would render a patient hypercoagulable. Beta-thalassemia may lead to splenomegaly and splenic sequestration of platelets but is not a major cause of bleeding disorders. The prevalence of vWD is believed to be as high as 1-2%, although the incidence of severe (homozygous) vWD is only one in a million.

14.3. [C] Factor VII is used in the management of hemophiliacs and recently its use have been investigated for management of bleeding that does not responds to conventional therapy .

14.4. [A] Autologous blood transfusions are advocated by some to minimize allopathic transfusions in the periperative period

14.5. [C] Blood transfusions are unlikely to cause hypercoagulability.

15. Specialized Nutrition Support in Critically Ill Patients

15.1. [C] Phosphorus regulates the amount of 2,3-diphosphoglycerate (2,3-DPG) in red blood cells. 2,3-DPG promotes the release of oxygen by hemoglobin thus delivering oxygen to tissues. Thus, reduced RBC 2,3-DPG levels are associated with a shift to the left of the oxyhemoglobin saturation curve. This shift to the left is associated with a decrease in the release of oxygen to peripheral tissues and may result in tissue hypoxia.

15.2. [D] The human body is not capable of synthesizing fatty acids with a double bond between the ninth and terminal carbon of the fatty acid chain. Therefore, linoleic acid and α-linolenic acid are essential fatty acids in man. Arachidonic acid may be synthesized from linoleic acid and is therefore conditionally essential to the human body.

15.3. [D] Most current randomized, prospective studies evaluating enteral vs. parenteral nutrition after major trauma has concentrated on patients with head injuries, blunt and penetrating injuries, and burns. Although both enteral and parenteral feeding are commonly used in the ICU setting, current evidence suggests that enteral delivery of nutrition significantly reduces subsequent septic complications, presumably because of the preservation of gastrointestinal barriers and host defenses.

15.4. [C] This patient is currently experiencing minimum stress, therefore her calorie and protein requirements can be estimated to be 25-30 total kcal/kg/day and 1.5 gm protein/kg/day, respectively. Only the TPN regimen outlined in answer C would meet these needs. All of the other TPN regimens provide excessive amounts of calories and protein, placing this patient at risk for adverse events related to overfeeding.

15.5. [C] Surgical procedures may frequently cause malabsorption requiring nutritional intervention. Parenteral nutrition may be indicated in the immediate postoperative period following a subtotal gastrectomy if significant malnutrition is present. Factors leading to malnutrition as a result of this procedure include impaired mechanical digestion of food by the deformed stomach, more rapid and less regulated gastric emptying, and decreased intestinal transit time. Parenteral nutrition is generally not required following an esophagogastrectomy because the gastrointestinal tract is nearly always functional. Patients undergoing vagotomy/pyloroplasty can usually be managed with an antidumping diet. This oral diet includes frequent small meals, avoidance of simple sugars to decrease the osmolality of food, and increased complex carbohydrate intake.

15.6. [C] A recent analysis of perioperative nutrition support suggests that significant improvements can be demonstrated when parenteral nutrition is given to severely malnourished patients in adequate amounts for ≥7-15 days preoperatively. Benefits from parenteral nutrition include an improvement in anthropometric measurements, reduction in major complications (i.e., intra-

abdominal abscess, peritonitis, anastomotic leakage), a decrease in postoperative sepsis, and lower postoperative mortality. Data available from published reports suggests that administration of parenteral nutrition <7 days in the preoperative period is unlikely to significantly improve outcome in severely malnourished patients.

15.7. [C] Adults are considered at risk for developing malnutrition if they have inadequate nutrient intake for ≥7 days or if they have lost ≥5% of usual body weight in 1 month, ≥10% of usual body weight within 6 months, or are 20% under ideal body weight. The onset or development of malnutrition should be prevented or slowed by giving appropriate patients optimum nutrition therapy. If the gastrointestinal tract is compromised, parenteral nutrition should be initiated to replenish and maintain nutrient stores.

16. Routine Monitoring in the ICU

16.1. [C] See reference 1 in reading list.

16.2. [D] The first line therapy for oliguria is fluid resuscitation. If urine output declines after adequate fluid resuscitation, a PA catheter may be indicated.

16.3. [D] The opposite is true. The CVP tracing dampens (flattens) with tachycardia.

16.4. [B] The risk of pneumothorax is smaller, but not zero, with the internal jugular approach compared with the subclavian approach.

16.5. [E] The major drawback of a ventriculostomy is an increased rate of infection.

17. Rational Use of the Pulmonary Artery Catheter (PAC)

17.1. [C] The PAC with special capabilities for ejection fraction and end diastolic volume makes those measurements only on the right side of the heart by a modification of the thermodilution technique. Left ventricular end diastolic volume and ejection fraction cannot be monitored with a right sided PAC.

17.2. [B] The determinants of oxygen delivery are cardiac output, hemoglobin, and arterial oxygen saturation when looking at total body or global oxygen transport. The determinant of oxygen demand is oxygen consumption. Sv02 monitors the balance of this supply and demand but does not reliably correlate with any of the four factors.

17.3. [A] Pulmonary artery rupture is a rare but commonly lethal event with pulmonary artery monitoring. It occurs most commonly with elevated pulmonary artery pressures as might be seen in mitral stenosis or primary pulmonary artery hypertension. Wedging the catheter in these conditions is commonly difficult and the high pressures seem to put the patient at risk for vessel rupture when the balloon on the tip of the catheter is inflated.

17.4. [B] When floating a PAC from the preferred site of the right internal jugular vein, the catheter will enter the right atrium at 20-25 cm. Advancing the catheter to 30-35 cm will cause the catheter to cross the tricuspid valve and enter the right ventricle. A pulmonary artery trace will be seen on the bedside monitor at 40-45 cm. Finally, a wedge position is commonly obtained at 50-55 cm. Knowing these distances is essential for the safe passage of a PAC and the avoidance of looping and knotting in the heart.

17.5. [D] The greatest measurable disturbance in global oxygen supply and demand occurs in cardiogenic shock. Low cardiac output causes excessive extraction of oxygen from arterial blood and a low mixed venous oxygen saturation. Thus there is a correlation between the severity of cardiogenic shock and SvO_2. That is not true in septic, anaphylactic, or spinal shock where cardiac output is high and SvO_2 is high and may not correlate with the hemodynamic disturbance of loss of peripheral resistance that characterizes these other clinical problems.

18. Echocardiography in the Intensive Care Unit

18.1. [B] The evaluation of the hemodynamically unstable patient is a Class I recommendation for echocardiography. Pressure parameters obtained from pulmonary artery catheters or central venous lines are oftentimes misleading or misinterpreted. A focused examination with the acquisition of 2D images may add to diagnostic process and possibly redirect management strategies. Although echocardiography is used in the other scenarios of the questions, the strength of supporting evidence or expert opinion that echocardiography improves outcome is less.

18.2. [D] The TEE probe has a diameter of around 1 cm and may inadvertently lead to an esophageal injury, tear or rupture in the setting of esophageal strictures. Rheumatic arthritis

requires careful evaluation for atlantoaxial instability. TEE probe insertion and manipulation should be performed extremely cautiously. TEE can be performed safely in the liver transplant recipient even in the presence of esophageal varices and coagulopathy.

18.3. [A] Initial resuscitation efforts should be focused around the basic principle of airway, breathing, and circulation as simple maneuvers may stabilize the patient. TEE may help in the diagnosis and management of refractory life-threatening instability.

18.4. [D] Aortic dissection may lead to aortic regurgitation should the intimal flap tear through the aortic valve and acute pericardial effusion with tamponade and involvement of the coronaries may result in acute myocardial ischemia and dysfunction. A D-shape ventricle is the hallmark of a volume or pressure overloaded right ventricle in which the intraventricular septum is flattened by the increased right sided pressure pushing the septum across to the left ventricular cavity.

18.5. [D] Loculated hematoma or fluid collections within the pericardium or mediastinum in the postcardiac surgical patient may lead to obstruction of any lower pressure chamber including the left atrium. Typically, the left ventricle is underfilled and the left ventriulcar enddiastolic dimensions are decreased. Diastolic collapse may be seen in the right atrium, right ventricle or left atrium. The inferior vena cava is dilated without any respiratory variation in its diameter.

18.6. [C] Acute coronary syndromes may lead to myocardial dysfunction. On echocardiography decreased myocardial systolic thickening and excursion is noted. Typically, the left ventricle is involved leading to diastolic failure with increased diastolic area and possible biventricular failure with an increased right ventricular size. "Kissing papillary muscles" is often observed during hypovolemia and describes the process of the posteriomedial and anterolateral papillary muscles coming together very closely during ventricular systole.

19. Airway Management in the Intensive Care Unit

19.1. [C] The neck must be maintained in-line to prevent injury and reduce the potential for further injury. Nasal or oral intubation is acceptable, depending on other injuries, patient condition, urgency of intubation, etc. A lateral C-spine film can be used to document injury, but a "normal" film does not rule out ligamentous injury or instability. While there is controversy as to whether a multi-slice CT scan with reconstruction images alone or MRI is required to rule out all injury, it is generally accepted that a more advanced study than plain films is required.

19.2. [D] Positive pressure ventilation can actually be provided by mask, e.g., BiPap. Hypercarbia can be a patient's normal status or can be a result of a loss of FRC and can, therefore, be treated with CPAP. In addition, if due to a medication effect, hypercarbia may be amenable to a reversal agent such as naloxone for narcotics or flumazenil for benzodiazepines. While ventilation can be provided to the obtunded patient by other means, intubation may be considered necessary for airway protection. However none of these are absolute indications for oral-tracheal intubation.

19.3. [A] Cricoid pressure involves gentle backwards pressure of the cricoid cartilage on the esophagus to prevent passive aspiration of gastric contents in patients at risk for aspiration, such as patients with full stomachs or active gastric-esophageal reflux disease (GERD). However, it will not prevent aspiration with absolute certainty and thus, rapid sequence intubation involves quickly pushing medications to achieve optimal intubating conditions as rapidly as possible and performing direct laryngoscopy and placing the ETT as soon as possible. Aspiration of gastric contents is certainly possible in patients with full stomachs, for example a patient with a small bowel obstruction. When performing cricoid pressure, it should be continued until the ETT is confirmed in the trachea by end-tidal CO2 and bilateral breath sounds rather than releasing the pressure immediately after the ETT is placed.

19.4. [C] The Cook airway exchange catheter is designed to help guide placement of the new ETT. In addition, one is also capable of using the catheter to jet ventilate the patient or provide oxygen insufflation with the standard adapter. After dislodgement of the catheter, replacement is not generally feasible, particularly when direct laryngoscopy is found to be difficult with a grade IV view. One now has to consider the management of a difficult airway. After calling for help, the next step is to attempt ventilation and establish an airway by mask ventilation. If this is successful, then mask ventilation can be continued until the airway is secured with more sophisticated maneuvers, including but not limited to fiberoptic inbution, intubating laryngeal mask airway (LMA). If bag mask ventilation is inadequate, then consideration for other airways must be given, with transtracheal jet ventilation and cricothyroidotomy being the final steps in the difficult airway algorithm.

20. Chronic Airway Management

20.1. [D] All other options are indications for tracheotomy
20.2. [D] Although not mandatory, fiberoptic guidance during percutaneous tracheostomies helps to avoid injuries and assures final tube position.
20.3. [B] Tracheal buttons delay stoma healing
20.4. [B] Acute pneumothorax is an acute complication
20.5. [D] Major complications can occur during tracheotomy tube changes. It should be only performed after a secure tract has formed

21. Management of Mechanical Ventilation

21.1. [D]
21.2. [B]
21.3. [B]
21.4. [D]
21.5. [A]
21.6. [B]
21.7. [B]

22. Side- Effects of Mechanical Ventilation

22.1. [B] Large tidal volumes and high airway pressures can result in ventilator-induced lung injury. Injury is postulated to arise from mechanical and biological factors. Most patients do not have macroscopic lung damage; the underlying lung damage is worsened by VILI.
22.2. [D] Mean airway pressure is determined by tidal volume, minute ventilation, level of PEEP, and inspiratory time. Increased inspiratory time results in increased mean airway pressure. Increasing mean airway pressure increases oxygenation.
22.3. [E]
22.4. [E] Intrinsic PEEP (a.k.a. auto-PEEP) has the same side-effects as extrinsic PEEP. It is, however, often unrecognized. Additionally, since ventilator triggering usually requires the generation of either a set pressure or flow drop, intrinsic PEEP, when not accounted for, may increase the difficulty in triggering the ventilator.
22.5. [B]
22.6. [B] Patients with COPD exacerbations have improved outcomes with noninvasive ventilation strategies compared with intubation. Noninvasive ventilation is best suited for awake, cooperative patients. Gastric distension may occur. Patients are also at an increased risk for aspiration.
22.7. [C] Tracheal injury may occur with limited periods of intubation. However, the risk increases with increased duration of intubation. Evidence of tracheal dilation on CXR is a relatively late sign of tracheal injury.
22.8. [A]

23. Lung Protection Strategies

23.1. [B] False. ALI/ARDS is most commonly a syndrome involving heterogeneous lung injury, despite CXR appearances.
23.2. [C] Diagnosis of ALI/ARDS requires correlation between radiological information and gas-exchange characteristics (e.g. paO2/FiO2 ratio of less than 200 for ARDS, and between 200 and 300 for ALI) in addition to absence of increased hydrostatic pressure (e.g. heart failure from LV-dysfunction, other).
23.3. [D] All of the above. Gender and height of a given patient give rise to an ideal body weight which is considered for ventilation in ALI/ARDS rather than the actual body weight. This favors normalization of tidal volumes to lung size for a given patient. Initial arterial blood gas analysis can be used to estimate minute ventilation requirements and PEEP/FiO2-levels, with adjustments being made as needed based on follow-up ABG's (after the initial ventilator prescription has been instituted)
23.4. [E] All of the above. Best available data suggests improvement in patient outcomes by use of a coordinated strategy involving lung protective ventilation and negative fluid balance.

24. Weaning From Mechanical Ventilation

24.1. [E] References 6 and 7 emphasize the value of T-piece weaning.
24.2. [D] It is important to know how to set the ventilator (Reference 4).
24.3. [E] Reference 7 emphasizes protocol-driven techniques in hastening ventilator weaning.
24.4. [D] See the failure to wean checklist in the text.
24.5. [A] These parameters are consistent with adequate ventilatory reserve for extubation.
24.6. [C] References 6 and 7 emphasize the SIMV is an inefficient mode in chronic weaning.

25. Support of the Failing Circulation Shock

25.1. [A]
25.2. [D]
25.3. [A]
25.4. [E]
25.5. [C]
25.6. [C]

26. Diagnosis and Treatment of Dysrhythmias

26.1. [E]
26.2. [A]
26.3. [D]
26.4. [E]
26.5. [A]
26.6. [D]
26.7. [A]

27. Diagnosis and Treatment of Myocardial Ischemia

27.1. [C]. Most PMI are subendocardial
27.2. [B]. ACE inhibitors are contraindicated in patients with renal failure
27.3. [A]. B-Blockers should be taken indefinitely after an MI
27.4. [C]. By increasing oxygen delivery the myocardial damage might be limited
27.5. [C]. Patients with stents have a risk of thrombosis of stents in the perioperative period, particularly if anticoagulation is stopped.
27.6. [D]. The other factors are related to the possibility of the presence of CAD but have not been demonstrated that they increase risk of PMI independently.

28. Valvular Heart Disease

28.1. [E] This patient may have aortic stenosis. The extent (area and peak-to-peak gradient) of the disease process is not known. If the patient has significant aortic stenosis, the hemodynamic management aims to avoid tachycardia with maintenance or restoration of sinus rhythm. Both ejection time as well as diastolic filling time is reduced wit tachycardia, increasing the work of the heart (the stroke volume has to be ejected in a shorter time frame requiring the generation of higher LV pressures) while decreasing the time for the LV chamber to fill. Maintenance of afterload is a close second priority to ensure adequate coronary perfusion pressure.
28.2. [C] Patients with severe mitral stenosis have a large left atrial-left ventricular pressure gradient that permit large atrial volume and pressure, causing left atrial enlargement, left atrial dysfunction, and atrial fibrillation. TEE is the best tool to identify any clot formation, particularly in the left atrial appendage. Cardioversion is less successful when the atrium is dilated (>4.5 cm^2).
28.3. [B] If a patient has a dysfunctional prosthetic mitral valve, the best diagnostics tool to assess the integrity and function of the valve is TEE. Transthoracic echocardiography can not visualize the mitral valve apparatus well because of acoustic shadowing from the mechanical device.
28.4. [C] Intraaortic balloon pulsation is useful in all of the above critical situations except aortic insufficiency, in which the pathology would be augmented by IABP.

29. The Systemic Inflammatory Response Syndrome (SIRS), Sepsis and Multiple Organ Dysfunction Syndrome (MODS)

29.1. [E] SIRS is the starting point of a continuum that extends to Multiple Organ Dysfunction Syndrome. Given the recent occurrence of the injury, the hyperdynamic state the pt is in is consistent with this diagnosis. There is no evidence of hypotension and both MH and thyroid storm would be associated with fevers. Opioid overdose would cause bradypnea.

29.2. [D] The hallmark of the sepsis syndromes is microcirculatory endothelial dysfunction with massive endocapillary leak leading to edema and hypoperfusion. The patient has an elevated wedge pressure with persistent hypotension despite massive resuscitiation. At this point, the patient would not benefit from more fluids and needs vasopressors to restitute peripheral vascular tone.

29.3. [C] All of the above measures are indicated in conjunction with initiation of broad-spectrum antibiotic therapy as soon as cultures are taken depending on the most likely pathogens. Once the organism is identified, antibiotics should be de-escalated and tailored to the particular pathogen, eliminating those antibiotics not needed.

29.4. [D] In acute tubular necrosis, the kidney loses its ability to concentrate and filter. Sodium is very efficiently retained with normal kidney function, therefore a high concentration of this ion in the urine is indicative of intrinsic renal damage. All of the other options are consistent with prerenal (hypovolemic) failure.

29.5. [A] Although there are subsets of septic patients who are cortisol deficient, this condition is not always present. A random cortisol level followed, if needed, by cortisol stimulation test helps identify those patients who are likely to benefit from steroid replacement. The other options are present in septic shock.

30. Nosocomial Infections

30.1. [E] All of the answers have been implicated in studies to contribute to nosocomial infections in the ICU. Length of ICU stay has been shown as the predominant risk factor, which is not surprising given that the less time spent in the ICU usually translates into less time for exposure to other risk factors such as mechanical ventilation and central venous cannulation.

30.2. [B] Arterial catheters are now believed to have complication rates similar to those for venous catheters. Thrombotic complications have been reported to occur in 19-38% and infections in up to 23% of patients with indwelling arterial catheters.

30.3. [C} Alcohol-based hand sanitizers have improved the compliance and thus the reduction of nosocomial infections throughout the hospital setting. Alcohol-based sanitizers have excellent germicidal action against gram-postitive and gram-negative bacteria, many viruses including Human Immunodeficiency virus and influenza virus. However, these products are not effective against bacterial spores such Clostridium Difficile. Warm soap and water hygiene are therefore still recommended for patients infected with Clostridium Difficile.

30.4. [E] You should wear gloves any time there is the possibility of exposure to blood or body fluids. Gloves alone are adequate for drawing venous blood or placing an intravenous line, for example. More equipment is required if there is a reasonable risk of splash. Fluid-resistant masks and eyewear should be worn any time there is a splash potential, such as during an arterial stick, or drainage of an abscess under pressure. Masks should always be used in conjunction with protective eyewear, such as goggles or masks with eye shields. Fluid-resistant gowns are worn any time there is a significant risk of splash of blood or body fluid during a procedure. If the splash is predictably limited, as in nasotracheal suctioning, manipulating an intravenous line, or drawing an arterial blood gas, then gloves, mask and eyewear are adequate.

30.5. [A] Several studies have now demonstrated that routine replacement of central venous catheters every 7 days did not reduce the rate of catheter-related bloodstream infections. Furthermore, increased complication rates have been associated with the practice of routine replacement and it is no longer recommended.

31. Infections and Antibiotic Therapy in the Intensive Care Unit

31.1. [A] Severity of acute and chronic illnesses is probably the most important predictor. After controlling for other factors, gender by itself is probably not a risk factor for infection.

31.2. [B] The most common site of colonization is the oropharynx/airway. Differentiating between organisms causing infection vs. colonization is difficult.
31.3. [C] *E. coli* and *B. fragilis* are the most common organisms cultured from intraabdominal abscesses. *S. pneumonia* and *H. influenzae* cause community acquired pneumonias. Although *C. albicans* is frequently isolated from the airway, it rarely causes pneumonia in patients who are not severely immunosuppressed (neutropenic leukemic, bone marrow transplant recipients).
31.4. [D] If 10,000 CFU/ ml are isolated, repeat culture may be warranted.
31.5. [B] Proven line infections require replacement of the catheter to a new site unless absolutely impossible. Routine changing of catheters without evidence of infection is not warranted.
31.6. [D] Cefepime, Tobramycin, and Imipenem all have useful anti-*Pseudomonas* activity.
31.7. [B] Full barrier precautions and meticulous aseptic technique are important actions during insertion and maintenance of central venous catheters.
31.8. [C] Voriconazole is preferred for aspergillosis.
31.9. [A] Reported to be as high as 4%. The incidence is probably lower if dosing is adequately adjusted for renal dysfunction. Meropenem does not appear to be nearly as epileptogenic.

32. Antibiotic Prophylaxis

32.1. [C] Common exceptions include evidence of perforation (as in case sited) or possible ongoing infection (cholecystitis or appendicitis). Nonetheless, even in these cases antibiotics can generally be given for one day or less.
32.2. [A] In fact, prophylaxis for the actual duration of the operation only (no postoperative doses) may be adequate, though this is unproven.
32.3. [B] Despite all efforts, there remains a low but real wound infection rate even under ideal circumstances. These infections are probably due to bacteria found in hair follicles, sweat glands, etc., that may be out of reach of both skin cleansers and systemic antibiotics.
32.4. [D] For many reasons, including: traumatic wound, perforated viscus, unprepared colon.
32.5. [B] Important, of course, when choosing antibiotics. All others are also found in the colon, but do not predominate.
32.6. [B] Based on studies of both serum and tissue (colon) levels. This issue may be related to why longer operations have consistently higher wound infection rates even when other variables are controlled.
32.7. [A] As a historical note, Köcher reduced his wound infection rate for thyroidectomy to 3%, without the use of effective skin antiseptics or antibiotics, just by using meticulous technique.

33. Management of the Immunocompromised Patient

33.1. [B]. Hypothyroidism is a delayed complication seen after 90 days post BMT. (refs 4,5)
33.2. [C]. During outbreak of nosocomial fungal infections, dry mopping was found to result in dispersion of 800 000 particles/m^3, whereas wet mopping resulted in dispersion of 30000 particles/m^3. [ref 5]
33.3. [A]. Opportunistic infections are less likely early after transplant since the state of immunosuppression is not developed. (ref. 6)
33.4. [B] Macrolides inhibit RNA-dependent protein synthesis by reversibly binding to the 50S ribosomal subunit (ref.8)
33.5. [D] In microbiologically documented infection, use of the most narrow-spectrum agent possible is recommended (ref. 8)
33.6. [A] Fever is infrequent sign of rejection in kidney transplant. (ref. 12)
33.7. [D] Humidification of the inspired air by heated humidifier causes liquid condensate to rain out in the circuit and to become contaminated with high-level bacterial growth; washing back of the liquid through the patient's endotracheal tube, a potent inoculum is delivered directly to the lower respiratory tract. The greater the manipulation of the ventilator circuit, the greater the risk for lower respiratory tract infection. It is recommended that the ventilator circuit should not be changed on schedule. (ref.13)
33.8. [E] Interstitial pneumonitis has been associated with therapeutic as well as toxic levels of sirolimus. Metastatic pulmonary calcification is frequently associated with renal failure and renal transplants but it has been documented in patients with liver transplant without renal insufficiency. Right-sided diaphragmatic dysfunction is a common complication of liver transplantation as a result of phrenic nerve injury. After heart transplantation, there typically is

a worsening of the impairment in diffusing capacity that persists for years after transplantation (ref 14)

34. Neurologic Critical Care

34.1. [B] Symptomatic vasospasm is manifested by a gradual decrease in level of consciousness in most cases, and in some cases is associated with hemiparesis, mutism, and even apraxia. Some patients have fluctuation level of consciousness. Clinical signs usually appear between 4 and 14 days following the subarachnoid hemorrhage, and peak at day 7. Commonly accepted treatment for symptomatic cerebral vasospasm is to increase the cerebral perfusion pressure by increasing mean arterial pressure through volume expansion and judicious use of vasoactive agents.

34.2. [D] These symptoms are consistent with bacterial meningitis, but may represent other illnesses, which should be looked for if the CSF is normal. CSF leukocyte count >1000 is commonly seen with bacterial meningitis, as is a reduction in CSF glucose and increase in CSF protein. A traumatic puncture may result in bloody CSF, but the proportion of SBC to RBC will still allow determination of increased CSF leukocyte count.

34.3. [E] GBS is an acute inflammatory polyneuropathy which usually develops following an acute infection or mild respiratory syndrome. Its onset is gradual, over 3 - 21 days, with weakness appearing symmetrically in the legs, and ascending to involve respiratory muscles in about one-third of patients. Dysautonomia of varying degrees is common in these patients. In patients where GBS causes a bed-bound state or severe ataxia, plasma exchange or IVIG are preferred treatment options; steroids are not beneficial.

34.4. [D] Neuroleptic malignant syndrome is a curious and often unrecognized consequence of administering neuroleptic drugs, as often occurs in the ICU. Like malignant hyperthermia, NMS leads to sustained muscular contraction, and thermogenesis; rhabdomyolysis has been reported. Sodium dantrolene has been used for treatment of NMS, but with inconsistent results. Discontinuation of neuroleptic agents and administration of appropriate supportive therapies are initial management strategies. Some advocate the administration of bromocriptine, amantadine, and levodopa/carbidopa to modulate central dopaminergic tone and alter thermoregulation.

34.5. [A] Waxing and waning, or a changing localized neurologic pattern is not characteristic of peripheral neuropathy, cerebral ischemic infarct, or expanding mass lesions. Intracranial hypertension that produces deterioration in neurologic status does not resolve until ICP deceases. Ischemic episodes, as occur with transient ischemic attacks and with cerebral vasospasm, are often associated with a waxing and waning neurologic state.

34.6. [E] All choices are obvious concerns for the comatose, head injured patient. In addition, coagulopathy may be of concern.

34.7. [E] Hypoxia, hyperthermia. Anemia, hyperglycemia and diminished autoregulation may have deleterious effects on neurologic outcome. Hypothermia may have a protective role.

34.8. [D] Acute ischemic stroke could be embolic or atherothrombotic. BP should not be aggressively lowered. Echocardiography is required to identify a source of embolus. Thrombolysis within 3 hours of onset is associated with improved neurologic outcome. Antiplatelet therapy is also recommended.

34.9. [D] ICP monitoring is indicated in patients with severe head injury (GCS < 8) and abnormal head CT finding or patients with severe head injury (GCS < 8) and normal head CT if more than 40 years old, posturing, or systolic BP < 90 mmHg.

34.10. [B] Edrophonium test is used to diagnose not treat myasthenia grravis. All others are used to treat the disease.

35. Traumatic Brain Injury

35.1. [D] Cooper et al (Ref 18) compared patients resuscitated with Hypertonic saline versus patients resuscitated with LR/NS and demonstrated identical neurological function at 6 months.

35.2. [D] The use of chronic and profound (25 mmHg) hyperventilation is discouraged. (Class I evidence guideline). (Ref 2) Hyperventilation may decrease CBF and reduce brain oxygenation.

35.3. [D] Many factors can make airway management in the TBI patient challenging. A cooperative non intoxicated patient is not one of them

35.4. [C] Initial surgical decompression is aimed to minimize the initial injury
35.5. [B] Hypocarbia and the use of steroids are listed in the guidelines as "not to do" interventions. (Ref 2) Early feeding is recommended as head injury is a hypermetabolic state. Seizure prophylaxis for seven days is recommended.

36. Management of Increased Intracranial Pressure

36.1. [C] All but prophylactic hyperventilation is recommended by the Guidelines for the Management of Severe Head Injury. Historically patients in whom adequate hemodynamic resuscitation has not been achieved have experienced worse neurologic outcomes. Muizelaar, et al. have demonstrated deleterious consequences of prophylactic hyperventilation, presumably secondary to further vasoconstriction and decreased blood flow to already ischemic brain.
36.2. [A] Head injury patients who are following commands (GCS 9-15) are at low risk for increased ICP and may be followed with sequential neurologic exams. Exceptions include those patients with traumatic mass lesion, in which ICP monitoring may be indicated. Certain patients with severe head injuries but normal head CT scans are at risk for increased ICP. Those with 2 of 3 adverse features should be monitored for ICP: age >40, unilateral or bilateral motor posturing, or systolic BP <90.
36.3. [D] Mannitol is a very useful diuretic agent in lowering ICP. However, by doing so the patient is made hypovolemic. This results very commonly in a rise in serum sodium. In addition, renal function should be monitored closely.
36.4. [A] A young patient who arrives to the emergency room with a suspected severe head injury and hypertension should never have the blood pressure lowered artificially until the ICP is known. By using the simple formula for CPP one can see that if the patients ICP is high, a high MAP may be needed to maintain CPP ≥ 70.
36.5. [B] The Cerebral compliance by definition is the change in volume divided by the change in ICP. As a mass occupying increases in size, initially the intracranial compartment will accommodate. However, when a critical size is reached the intracranial components will reach maximum compliance and the ICP will increase linearly with change in volume. Figure 1.
36.6. [D] Steroids have no role in the management of patients with head injury.
36.7. [B] In most clinical studies performed on hypothermia there are some benefits in the head injured population. There is reproducible data to suggest it is effective at lowering ICP. However, there is no clear evidence that it improves functional outcome.
36.8. [A] Autoregulation is defined as the ability of the brain to maintain adequate cerebral blood flow over a wide range of MAP. Intrinsic to this phenomenon are various metabolites in the blood that are vasoactive including CO2. In an injured brain autoregulation is ineffective.
36.9. [C] Mild hyperventilation is defined as an arterial CO_2 of 30-35. Due to the fact that hyperventilation causes rapid vasoconstriction of the cerebral blood vessels it may exacerbate ischemia. Therefore, it should be used for short intervals at a time, particularly for intracranial hypertension crisis.

37. Renal Protection

37.1. [C] A prerenal state implies oliguria due to hypovolemia (i.e., decreased renal perfusion), in which damage to the renal tubules has not yet occurred. An appropriate tubular response is sodium retention and urinary concentration, in an effort to restore the intravascular volume. Urine sodium will be low (<20 mEq/L) and fractional excretion of sodium (FE_{Na}, the sodium clearance expressed as a percentage of the creatinine clearance) less than 1%. Activation of tubular concentrating ability results in a high urine specific gravity (>1.020), urine to plasma osmolar ration (>1.5) and urine to plasma creatinine ration (>30). The converse occurs once acute tubular necrosis (ATN) is established: the tubules are no longer able to conserve salt and water, so that the urine has a high sodium concentration and is dilute, despite hypovolemia.
37.2. [E] The urine test for myoglobin is a qualitative, not quantitative. It may be intermittently negative despite active rhabdomyolysis. Although urine myoglobin and myoglobin clearance are the most accurate prognostic indicators of the risk of renal damage, they are not routinely measured. The total CPK serves as a useful guide to the extent and severity of muscle necrosis; once the CPK level exceeds 10,000 IU/L the risk of renal injury progressively increases. Animal studies have indicated that acute renal failure is more likely with myoglobinuria when urine pH is less than 6; in an acidic milieu myoglobin is converted to

ferrihematin, which is toxic to the tubular cells. Addition of one ampule of sodium bicarbonate to the maintenance IV is usually sufficient to alkalinize the urine to a pH >6. The most effective means of renal protection in rhabdomyolysis is to maintain a high tubular and urine flow by aggressive fluid administration.

37.3. [D] Normally, intraabdominal pressure is close to atomospheric pressure. When it is increased >20 mmHg, e.g., by hemorrhage, a marked reduction in cardiac output and renal blood flow (RBF) follows. Fluid administration can restore the cardiac output, but RBF remains low, because of renal vein compression. High renal venous pressure impedes glomerular filtration. Administration of furosemide, mannitol and/or low dose dopamine may transiently increase urine flow rate, but they do not correct the fundamental problem. Indeed, the elevated intraabdominal pressure is transmitted to the mediastinum to that PAP and PAOP may overestimate the effective, or transmural, filling pressure of the left ventricle. Fluid challenge could therefore be considered, but ultimately restoration of RBF and urine flow rate depends on relief of the intraabdominal hypertension. Surgical exploration should be considered when oliguria is associated with an intraabdominal pressure >20 mmHg.

37.4. [D] It is quite possible that dopamine administration may have an inotropic effect which increases cardiac output, renal blood flow, and glomerular flow rate, thereby increasing urine flow rate. However, in this situation, it is more likely that dopamine has had a direct effect on the tubules. Studies on the use of dopamine compared with saline administration during infra-renal aortic cross-clamping reveal that it induces a significantly greater diuresis but no greater protection against a decrease in glomerular flow rate than saline. It is now well known that dopaminergic receptors exist in the renal tubule which, when stimulated by dopamine, inhibit active sodium reabsorption and induce diuresis and salureses. Stimulation of presynaptic dopaminergic (DA-2) receptors inhibits the release of norepinephrine and contributes to renal vasodilation, but is likely to be less important than inhibition of sodium reabsorption in inducing diuresis.

38. Renal Replacement Therapy

38.1. [C] Mortality in AKI is around 50% depending on the series. All other alternatives are wrong

38.2. [D] There is not evidence that demonstrate CRRT is better than IHD, despite its theoretical benefits

38.3. [B] Peritoneal dialysis had a role in the ICU before the introduction of CRRT. It is not very effective in solute removal but is cheap and does not require anticoagulation

38.4. [D] CVVHDF is probably the most common CCT used in the ICU as it offers good fluid control, maintenance of hemodynamics and allows both diffusion and ultra filtration.

38.5. The cellulose membrane is thicker and activates the inflammatory response. It is therefore not used in the critically ill. The synthetic membrane is thinner and is best for UF purposes.

39. Toxicology and Support of Patients with Drug Overdoses

39.1. [D] Cyanide, by blocking the cytochrome c in the electron transport chain, prevents the utilization of oxygen and consequently the mixed venous saturation increases (Reference 1)

39.2. [C] See Reference 1

39.3. [B] Isopropyl is converted to ketones, not ketoacids, so although the patient's breath has the aroma of ketones, he does not exhibit a metabolic acidosis (Reference 7).

39.4. [E] See Reference 12.

39.5. [D] See Reference 6.

39.6. [B] See Reference 10.

39.7. [C] Reference 13

40. Solid Organ Transplantation

40.1. [C]. See References.1, 3.

40.2. [D]. See References 1, 3

40.3. [D]. Coronary artery vasculopathy is a long-term complication of heart transplant with multifactorial etiology – in addition to the usual risk factors for CAD, complex immune mechanisms play a role.

40.4. [B]. Bronchiolitis obliterans is a late complication and rarely occurs in the first three months after lung transplant. See References. 7,8.

40.5. [E]. Apsergillosis is unlikely to develop early in the course of immunosuppression.
40.6. [A]. Mycophenolate, unlike calcineurin inhibitors, has not been linked to significant kidney dysfunction.

41. Organ Donation and Procurement in the ICU

41.1. [E]
41.2. [A]
41.3. [B]
41.4. [C]

42. Trauma Management

42.1. [B]
42.2. [E]
42.3. [C]
42.4. [True]
42.5. [C]
42.6. [True]
42.7. [B]
42.8. [True]
42.9. [D]
42.10. [True]

43. Burn Management

43.1. [D] the cleansing and irrigation of the wound gently debrides the necrotic tissue.
43.2. [C] 4 cc/kg/% burn surface per 24 hours of isotonic crystalloid. Half of the 24-hour calculated volume is to be administered in the first 8 hours.
43.3. [B] Mafenide acetate causes a hyperchloremic acidosis.
43.4. [E] When applied liberally, silver nitrate can cause all the above side-effects.
43.5. [A] Often there are no physical signs or symptoms indicating eventual respiratory distress in the first 24 hours following a burn. Given the possibility of a chemical pneumonitis and the eventual fluid resuscitation required it would be prudent to protect the airway at this time under controlled conditions.
43.6. [B] Feeding should be accomplished by the enteral route, as soon as possible. 25 kcal/kg body weight + 40 kcal/% burn is recommended. Daily caloric requirements for adult patients with burns greater than 20% of TBSA are estimated with nitrogen given in quantities that give a caloric-to-nitrogen ratio of 150:1 and calories in the form of glucose up to a dose of 5mg/kg/min, which is supplemented with a fat emulsion. Mineral and vitamin supplements are essential
43.7. [E] Torso escharotomy is the best intervention at this time considering his burns and the swelling from fluid administration is affecting ventilation.
43.8. [C] urine alkalinization with bicarbonate may facilitate clearance of myoglobin by preventing its entry into tubular cells. Renal function must be aggressively monitored to prevent acute tubular necrosis.

44. Obstetric Critical Care

44.1. [A] Most (85%) cases of preeclampsia affect women in their first pregnancy, rather than multips. Although young patients have a higher incidence of the disease, older parturients may present with more severe disease. Preeclampsia accounts for 20% of maternal deaths in the United States. The etiology remains unknown.
44.2. [D] A urine output of less than 400 mL in a 24-hour period is sufficient to diagnose severe preeclampsia. The diagnosis of severe preeclampsia would be indicated if any ONE of the following features were present: (1) systolic BP of at least 160 mmHg, or (2) diastolic BP of at least 110 mmHg, or (3) greater than 6 gm proteinuria in a 24-hour urine collection.
44.3. [D] The colloid oncotic pressure (COP) is reduced in normal pregnancy and is often decreased further in preeclamptic patients. The COP can be expected to fall slightly, not increase, postpartum.
44.4. [E] Thrombocytopenia occurs in 15-30% of women with preeclampsia or eclampsia. The classic manifestations of severe preeclampsia include several headache, visual disturbances,

CNS hyperexcitability, and hyperreflexia; cerebral hemorrhage is the leading cause of death. Angiotensinogen, angiotensin I, angiotensin II, and aldosterone levels decrease markedly in preeclamptic women.

44.5. [A] Hydralazine is not a myocardial depressant; it has direct smooth muscle relaxing properties. ACE inhibitors are contraindicated in the antepartum period because of potentially lethal fetal and neonatal sequelae. Sodium nitroprusside indeed results in the release of nitric oxide and is useful in the antepartum period, primarily for short-term use to control the pressor response to tracheal intubation.

44.6. [D] Approximately 70% of seizures in preeclamptic patients precede delivery.