1206. Which of the following mediators are likely to dominate the anti-inflammatory late stages of injury?
   a. TNF-alpha
   TNF-alpha is among the earliest of the proinflammatory mediators produced in response to injury. It is
   macrophage-derived, and its infusion can cause signs similar to sepsis. It promotes adhesion of white blood
   cells to the endothelium, induces neutrophil activation, and mediates the release of other proinflammatory
   cytokines.
   b. Interleukin-6 (IL-6)
   IL-6 is a proinflammatory mediator which is important in the induction of T and B cells and the
   acute phase response.
   c. Interleukin-10 (IL-10)
   IL-10 is an anti-inflammatory mediator produced by the host in an attempt to bring the organism back to
   homeostasis after surviving the early stages of injury. It acts to inhibit the release of a host of proinflammatory
   mediators, and infusion of IL-10 has been shown to improve survival in septic animals. Its potential role in
   causing late incidents of MOF and sepsis through relative immunosuppression via overproduction is being
   investigated.
   d. Intracellular adhesion molecules (ICAMs)
   ICAMs are molecules expressed by endothelial cells which bind activated neutrophils in the
   capillary lumen. They are seen in the early proinflammatory phase.
   e. L-selectins
   L-selectins are molecules expressed by activated neutrophils which aid in their binding to
   endothelium. Once bound, the neutrophils extravasate into the tissue to exert their proinflammatory
   effect.
   Correct answer is: c

Shock & Hypoperfusion: Inflammatory response-Theories
Reference: page 101

1204. A previously healthy 24 year old man fell 20 feet from a balcony in the French Quarter, landing on his back. On
arrival to the Emergency Room, he states that he cannot move his arms or legs. On physical examination, his blood
pressure is 70/35, his heart rate is 58 bpm, his arms and legs are warm and pink, and he smells strongly of alcohol.
After infusion of 2 liters of crystalloid, his
blood pressure is still only 80/40. The only finding on his trauma series is a C6-7 subluxation.
The most important next step in his management is:
   a. Continued administration of crystalloid until normotensive.
   While the patient surely needs continued volume administration for his presumed cord injury, the
   most important next step in treating his refractory hypotension is to rule out concomitant
   intraabdominal injury by trauma ultrasound or diagnostic peritoneal lavage.
   b. initiation of an alpha agonist to correct hypotension.
   As with the previous answer, refractory hypotension in this setting must be assumed to be from intraperitoneal
   hemorrhage until proven otherwise. Should a concurrent injury with an active source of bleeding be ruled out, the
   hypotension can be attributed to his cord injury and administration
   of an alpha agonist would then be appropriate.
   c. determination of blood alcohol level.
   While alcohol intoxication can mask symptoms and depress the level of consciousness, the
determination of blood alcohol level is not an integral part of the trauma workup.
   d. investigations designed to detect intraabdominal injury.
   The force imparted by a 20 foot fall onto one’s back is significant enough to cause intraabdominal
   injuries in addition to a neck subluxation. Refractory hypotension in this setting demands an
   immediate workup for sources of hemorrhage.
   e. expeditiously transporting the patient to the OR for emergent laparotomy.
   While persistent hypotension in the face of blunt trauma and a high cord subluxation may be from intra abdominal
   injury, immediate exploration is not warranted. A trauma ultrasound or diagnostic peritoneal lavage would be the
   most appropriate way of ruling out intraabdominal hemorrhage as the etiology of the hypotension.
   Correct answer is: d

Shock & Hypoperfusion: Types of shock, neurogenic, signs and symptoms
Reference: page 100
1190. Which of the following statements about the adequacy of resuscitation efforts is INCORRECT?

a. The accuracy of gastric tonometry is lost if the patient has undergone prior gastric acid suppression. 
   Gastric tonometry consists of placing a CO2-permeable balloon filled with saline in a patient’s stomach for 30 minutes, allowing the CO2 of the gastric mucosa to equilibrate. The balloon is withdrawn, the CO2 measured, and the arterial bicarbonate determined. From these values, the Henderson-Hasselbach equation is used to back-calculate the pH of the gastric mucosa. This technique only works if the patient has undergone prior gastric acid suppression.

b. The base deficit is a measure of the number of millimoles of base required to correct the pH of a liter of whole blood to 7.4. The base deficit is the number of millimoles of base needed to correct the pH of a liter of blood to 7.4. It is easily measured and has been shown to correlate with volume deficits.

c. The commonly used end points of urine output and vital signs do not always correlate with cellular perfusion. The most readily available and commonly used signs for adequacy of resuscitation are a urine output of 0.5 cc/kg/hr and normalization of vital signs. They are not completely accurate, however, and a low threshold for using other indicators of cellular oxygenation is prudent.

d. The adequacy of cellular perfusion is currently assessed through indirect measurement. At present, technology does not exist to directly measure cellular oxygenation. We must rely on indirect measurements to assess adequacy of perfusion.

e. 

Correct answer is: a

Shock & Hypoperfusion: Types of shock, Hypovolemic, Therapy
Reference: page 95

1191. Which of the following statements regarding treatment of a patient in hypovolemic shock is INCORRECT?

a. Colloid solutions have not been shown to improve mortality. Colloid solutions have not been shown to improve mortality and they are considerably more expensive than crystalloid. Therefore, isotonic crystalloid should always be used for initial resuscitation fluid.

b. Large-bore peripherallyVs are more efficient at volume infusion because they have a lower resistance to flow than a central line. Short, stubby peripherallyVs have a lower resistance to flow than longer central lines and are thus more desirable for access sites in the setting of hypovolemic shock when large volumes of fluid are sometimes rapidly administered.

c. If a patient in hypovolemic shock is still hypotensive after crystalloid boluses, blood should be administered and an agent designed to increase systemic vascular resistance should be started. There is no role for vasoactive agents in the management of hypovolemic shock. These patients usually have maximal systemic vascular resistances as compensation for their hypovolemia. They need crystalloid and, should the volume deficit be severe and ongoing, blood products.

d. Airway concerns should always be addressed first in any patient in shock.
Any critically ill patient with a new presentation or acute decompensation should be managed by the ABCs: airway, breathing, and circulation.

e. 

Correct answer is: c

Shock & Hypoperfusion: Types of shock, Hypovolemic, Therapy
Reference: page 95
1194. Which of the following statements regarding the possible etiologies of multi-organ failure is INCORRECT?

a. The two-hit hypothesis postulates that after mounting an appropriate response to some physiologic insult, the patient is left with a primed immune system which manifests an exaggerated immune response to a second challenge.

The two-hit hypothesis does theorize that a second challenge imposed on a previously primed immune system may be a precursor to an overactive inflammatory state.

b. The early physiologic stages after injury are marked by an ebbing of the immune system followed by a later proinflammatory state which can lead to SIRS or multi-organ failure.

The early stages after injury actually appear to consist of an immediate proinflammatory state as the organism tries to address the physiologic insult. When properly modulated, this is an appropriate function. When overexpressed, this proinflammatory state leads to the systemic inflammatory response syndrome. Later, anti-inflammatory and immunosuppressive mechanisms are brought into play to bring the organism back to homeostasis. If overmanifested, they can lead to a relative generalized immunosuppression and late incidents of sepsis or multi-organ failure.

c. Evidence has shown that intestinal mucosa is made permeable by sepsis.

Evidence has shown that the gut mucosal barrier is made permeable by sepsis. The mechanism is still being elucidated, but may be due to ischemia/reperfusion injury.

d. Anticytokine antibodies have shown therapeutic promise in animal studies.

Anticytokine antibodies showed a great deal of promise in animal studies, but those benefits have not been duplicated in human studies. The future may lie in multi-drug regimens as seen with chemotherapy and HIV/AIDS.

e. Correct answer is: b

Shock & Hypoperfusion: Inflammatory response, Theories
Reference: page 101

1195. Which of the following statements about therapies for cardiogenic shock is CORRECT?

a. Intra-aortic balloon pumps are timed to inflate during diastole and deflate during systole, actions which are designed to reduce afterload at the expense of perfusion of coronary arteries.

Intra aortic balloon pumps are timed to inflate during diastole and deflate during systole, and this functions to reduce afterload. This action also serves to augment perfusion of the coronary arteries rather than detract from it.

b. When cardiogenic shock is due to acute myocardial infarction, hypotension precludes emergent angioplasty and/or revascularization as options.

Considerable evidence exists that at a minimum revascularization and/or angioplasty have a role, and in some patients they should be considered first-line treatment. The poor results of thrombolytics in hypotensive MI patients are also well-described. The mechanism for this is unknown, but some feel that it is a matter of the drug simply not reaching the clot secondary to poor perfusion.

c. The use of thrombolytic agents in the setting of acute myocardial infarction shows a clear benefit when given within 12 hours of the onset of symptoms.

The therapeutic benefit of thrombolytic agents in the setting of acute MI is seen up to 12 hours from the onset of symptoms.

d. Intraaortic balloon pumps cause an increase in left ventricular end diastolic volume.

Intra aortic balloon pumps inflate during diastole and deflate during systole. This functions to decrease afterload and improve coronary perfusion pressure during diastole. One of the most important physiologic effects seen is a decrease in left ventricular end diastolic volume, and consequently left ventricular end diastolic pressure.

e. Correct answer is: c

Shock & Hypoperfusion: Types of shock, Cardiogenic, Therapies
Reference: page 98
1196. Which of the following statements about drugs used in the treatment of cardiogenic shock is CORRECT?

a. Amrinone acts through stimulation of beta receptors in myocardium to increase contractility. 
Amrinone increases contractility by phosphodiesterase inhibition. This inhibits the degradation of intracellular cyclic AMP, and results in higher intracellular calcium levels. This increases contractility.

b. Dobutamine acts through inhibition of phosphodiesterase which increases cyclic AMP levels and thus contractility in myocardial cells. 
Dobutamine increases contractility through the selective stimulation of myocardial beta receptors. It also has vasodilatory properties. It is a first-line agent in the treatment of cardiogenic shock.

c. Dobutamine, amrinone, and high-dose dopamine all possess vasodilatory properties. 
Dobutamine and amrinone both have vasodilatory properties, but high-dose dopamine (i.e. greater than 10 ug/kg/min) has vasoconstrictive properties.

d. Epinephrine should be strongly considered as an effective first-line agent in the treatment of cardiogenic shock. 
While epinephrine has potent beta-stimulating and thus inotropic effects, it also is a potent alpha stimulator as well. This increases afterload and myocardial work. Patients in cardiogenic shock frequently already have an elevated SVR, and require afterload reduction. Dobutamine is a better first-line agent because it has vasodilatory properties.

e. Dopamine at doses of 5 to 10 ug/kg/min has a largely inotropic action profile. 
Dopamine has a dose-dependent action profile. At 3 to 5 ug/kg/min, its actions are largely to increase renal blood flow. At doses of 5 to 10 ug/kg/min, it largely acts to stimulate myocardial beta receptors and have an inotropic effect. At doses greater than 10 ug/kg/min, it stimulates alpha receptors and has a chronotropic effect.

Correct answer is: e

Shock & Hypoperfusion: Types of shock, Cardiogenic. Therapies
Reference: page 98

1199. Which of the following statements about polymorphonuclear cells (PMNs) is NOT correct?

a. They are the largest producer of tumor necrosis factor-alpha (TNF-alpha) in response to tissue injury.
While TNF-alpha is a proinflammatory cytokine, it is produced largely by macrophages rather than PMNs.

b. They migrate through the endothelial barrier through a process called diapedesis. 
PMNs elaborate adhesion molecules known as selectins, and endothelial cells produce intracellular adhesion molecules (ICAMs). The PMNs in the capillary lumen bind to the endothelium by these surface makers. Once bound, the PMNs flatten themselves out along the endothelium and migrate through the endothelial cell layer by a process known as diapedesis. Once through and into the interstitium, they follow a chemotactic gradient to the site of injury where they release a host of proinflammatory substances.

c. Experimental evidence has demonstrated that blocking the interaction of PMN and endothelial adhesion molecules reduces organ injury. 
Experimental evidence has shown that blocking the interaction of PMN and endothelial adhesion molecules reduces organ injury in primates. This has not yet been duplicated in human studies.

d. PMNs are nonspecific in their host defense functions. 
PMNs are phagocytic and nonspecific in their host defense functions.

e. 

Correct answer is: a

Shock & Hypoperfusion: Inflammatory response-Theories
Reference: page 101
1203. Which of the following are NOT appropriate interventions for decreasing the incidence of the systemic inflammatory response (SIRS) and multiple organ failure (MOF)?

a. Infusion of anti-TNF-alpha antibody.
   *Given the role which TNF-alpha has been shown to play in SIRS and MOF, blocking its actions by an antibody seems intuitively attractive. Further, animal studies gave hope that this modality would improve outcomes from these conditions. Sadly, studies in humans have not borne this out. Other trials with anti-IL-1 and anti-endotoxin also failed to show a therapeutic benefit.*

b. Early fixation of long bone fractures.
   *Early fixation of long bone fractures decreases fat embolus formation, and thus decreases the chance of an inflammatory lung injury.*

c. Decreased ventilatory tidal volumes.
   *Decreased tidal volumes reduce lung barotrauma and, consequently, the development of adult respiratory distress syndrome.*

d. Early enteral feeding.
   *Early enteral feeding helps to maintain the integrity of the lining of the gastrointestinal tract. By preserving this barrier, the translocation of bacteria from the gut lumen into the blood can be prevented.*

e. Correct answer is: a

Shock & Hypoperfusion: The inflammatory response- Therapies
Reference: page 101

1207. Which of the following statements regarding the abdominal compartment syndrome is CORRECT?

a. Diagnosis is made by the placement of intraperitoneal pressure transducers.
   *The abdominal compartment syndrome is often a clinical diagnosis based on historical factors such as massive volume administration in a patient with a condition predisposing to a capillary leak. The bladder does an effective job of transmitting pressure from within the abdomen, and the measurement of bladder pressures by instilling 100 cc saline through a Foley catheter and measuring the resultant pressure head can give objective evidence of increased intraabdominal pressure. There is no role for intraperitoneal pressure transducers.*

b. Once diagnosed, treatment consists of reopening the abdomen including doing so at the bedside if necessary.
   *The presence of an abdominal compartment syndrome requires decompression of the abdomen. If the patient is too unstable to be transported to the operating room, the abdomen should be promptly reopened at the bedside.*

c. The oliguria seen with this syndrome is secondary to hypovolemia, and is a sign that the patient needs further volume resuscitation.
   *The oliguria seen in abdominal compartment syndrome can occur in the face of euvoeemia. To treat it with ongoing volume administration in the face of an unrecognized compartment syndrome can, in fact, worsen the compartment syndrome. The mechanism of the oliguria is currently unknown. After decompression of the compartment syndrome, urine output frequently normalizes.*

d. The increased peak inspiratory pressures and hypercarbia are secondary to third-spacing of fluid in the pulmonary interstitium.
   *The elevated peak pressures and hypercarbia seen with this syndrome are the result of decreased diaphragmatic excursion secondary to increased intraabdominal pressures.*

e. Correct answer is: b

Shock & Hypoperfusion: Types of shock, hypovolemic, symptoms and therapy
Reference: page 95