CACCN Certification Study Guide

For use in preparing for the
Certified Nurse in Critical Care (Adult) – Canada examination

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The following questions are intended for **practice only** and represent a random sampling (but not exhaustive list) of possible topics that could be tested as part of the critical care certification examination.

Questions have been designed to test assorted competencies listed in the blueprint for the Canadian Nurses Association Certified Nurse in Critical Care Examination. The blueprint is available from the Canadian Nurses Association website at:

http://www.cna-aiic.ca/CNA/documents/pdf/publications/CERT_Critical_Care_Adult_e.pdf

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CASE 1

Mr. Jackle, 68 yrs old, is admitted with hypotension and respiratory distress requiring intubation following a large anterior-lateral ST elevation myocardial infarction.

Case 1: Question 1

Blueprint Competency Being Tested: 2.1b

Interprets data (initial and ongoing assessment or response to interventions) related to the cardiovascular system, including: laboratory results (e.g., cardiac enzymes and troponin, complete blood count [CBC], coagulation, arterial blood gases [ABGs], electrolytes, digoxin levels, lactate).

1. Mr. Jackle will be monitored for signs of reinfarction. Which one of the following lab tests would best indicate reinfarction?

a. Creatinine kinase
b. Cardiac troponin
c. Lactate dehydrogenase
d. Venous oxygen saturation

ANSWER A

Rationale for Correct Response:

Creatinine kinase (CK) and cardiac troponin follow a similar pattern of elevation following myocardial injury (CK ~2-8 hours; cardiac troponin ~3-12 hours post injury). CK will fall and normalize within 1-3 days, while cardiac troponin will remain elevated for 5-14 days. While troponin is more cardiac specific, its prolonged elevation can mask a secondary rise during reinfarction, that may be detected by the CK. Conversely, the persistent elevation in the troponin can be useful in detecting an infarct that is several days old.

Troponin is a protein that is important to the contraction of skeletal and heart muscles. Tests used to detect heart muscle are able to distinguish cardiac troponin from other muscle troponin. These tests are identified by cTn for cardiac troponin.

While CK will rise and fall during heart muscle damage along with troponin values, CK is non-specific and can rise for many other reasons. Even the more cardiac specific CK (CK-MB) lacks the specificity of troponin. Both values are typically ordered for the initial assessment of myocardial infarction to increase the level of confidence in the diagnosis of heart muscle damage (both should rise). The troponin is the more specific test.

There are 3 subtypes of the troponin protein (C, I, and T). Lab tests that are used to evaluate heart muscle damage specifically look for the cardiac specific troponin protein. Currently, lab tests are only available to detect the troponin I and T. The cardiac specific variety is identifies as cTnI or cTnT. The cTnT provides more standardized results than cTnC, but both tests will rise and fall in a similar manner.

High Sensitivity (hs) troponin test may also be available to detect heart muscle damage. A cTnT-hs is able to detect much lower levels of cardiac troponin T, providing earlier detection of an acute myocardial infarction. A negative cTnT-hs provides greater predictive value in ruling out a myocardial infarction. The increased sensitivity for detecting low levels of cTnT can also make it difficult to interpret the significance of small to moderate rises.

LDH would not be useful for detecting acute infarction or reinfarction, because it takes much longer to rise than CK or troponin (72 hours) and remains elevated for over 2 weeks. Venous oxygen saturation (decrease) is useful for detecting a low cardiac output but is not specific to myocardial infarction.

Case 1: Question 2

Blueprint Competency Being Tested: 2.1e

Interprets data (initial and ongoing assessment or response to interventions) related to the cardiovascular system, including: right atrial or mixed venous oxygen saturation measurements (e.g., oxygen delivery and consumption).

2. Mr. Jackle develops cardiogenic shock, respiratory failure and acute kidney injury (creatinine 325). He is receiving epinephrine at 2 mcg/min (0.03 mcg/kg/min) and is fully ventilated on: FiO_2 0.6 with PEEP 12. His SpO_2 is 95%, HR 74 (sinus rhythm), BP 102/58 (MAP 72), CVP 14 mmHg, Hb 82 g/L and central venous oxygen saturation (ScvO2) 42%. Which one of the following interventions may be considered?

a. Metoprolol (Betaloc)
b. Captopril (Capoten)
c. Increased FiO_2
d. Packed cells

ANSWER D

Rationale for Correct Response:

A venous oxygen saturation below normal (< 70%) indicates increased tissue oxygen extraction (i.e., the tissues are removing more oxygen than normal from each hemoglobin molecule at the cell level). A low venous oxygen saturation indicates that less oxygen is returning to the right side of the heart (the "leftover" oxygen). This indicates that the amount of oxygen being delivered is less than the cells required.

Refer to the formula for oxygen delivery. Cells will extract a higher amount of oxygen from the hemoglobin molecule if the oxygen delivery is too. This will generally be due to one of 4 possible reasons:

i. The cardiac output is too low
ii. The arterial oxygen saturation is too low
iii. The hemoglobin is too low
iv. The oxygen consumption (VO_2 or demand for oxygen) has increased without a sufficient increase in oxygen delivery

Oxygen Delivery = Cardiac Output (HR X SV) X Arterial Oxygen Content (SaO_2 X Hb)
In this example, the patient is still in shock (requiring epinephrine). Although we may want to get the patient converted to beta blockers, the patient is still requiring beta stimulation, therefore, metoprolol would be contraindicated at this point. ACE inhibitors are also part of the desired treatment following myocardial infarction, however, we would need to wait until his renal failure resolves to initiate captopril.

This patient is already on 60% oxygen and his SpO_2 is 95%. Additional oxygen would have minimal impact on the oxygen delivery.

Anemia drops the oxygen content, and necessitates an increase in the cardiac output to maintain the oxygen delivery. Although a hemoglobin of 82 g/L is generally well tolerated in patients without cardiac disease or among those who have an adequate oxygen delivery, in the setting of *coronary artery disease and ongoing shock*, transfusion to maintain a hemoglobin of at last 90-100 g/L is recommended.

Although there is still much debate regarding when to treat a low hemoglobin, administration of packed cells is the only appropriate option among the choices provided in this question.

Case 1: Question 3

Blueprint Competency Being Tested: 2.1c

Interprets data (initial and ongoing assessment or response to interventions) related to the cardiovascular system, including: ECG rhythm (e.g., cardiac rhythm, ectope, continuous ST segment monitoring, QT interval).

3. Mr. Jackle develops the following rhythm. Interpret this rhythm strip.

a. First degree block
b. Junctional rhythm
c. Second degree block
d. Complete heart block

ANSWER C

Rationale for Correct Response:

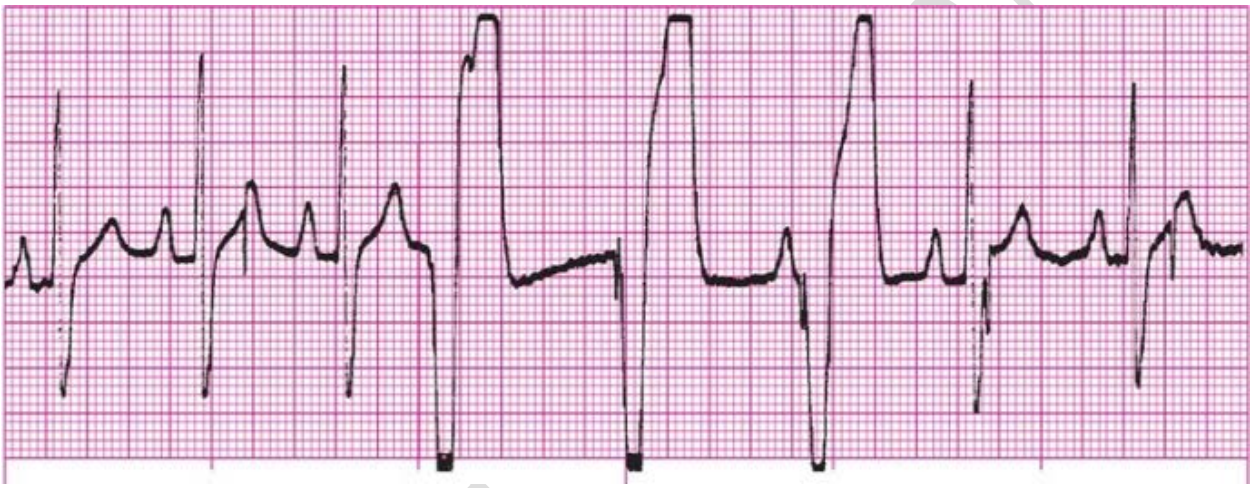
This is a sinus rhythm with a 2:1 second degree block. Note that the P waves that precede the QRSs have a consistent PR interval (indicating the QRS is related to the P). A second P is buried after the T waves and the P-P interval (buried and visible) are regular.

Case 1: Question 4

Blueprint Competency Being Tested: 2.6e

Selects appropriate evidence-informed nursing interventions to correct alterations in cardiac output, such as: optimizing heart rate or rhythm: pacing and cardioversion.

4. Mr. Jackle develops symptomatic bradycardia and requires a temporary pacemaker. The following rhythm strip displays his rhythm with a VVI pacemaker. Identify the pacemaker malfunction.



a. Failure to capture
b. Failure to pace
c. Oversensing
d. Undersensing

ANSWER D

Rationale for Correct Response:

This is undersensing or failure to recognize the patient's own native beat. The pacemaker fired when it should have inhibited.

Note the pacemaker spikes within the QT interval following the 2nd, 7th and 8th QRS. This indicates that pacemaker did not recognize the native beat and inhibit as it should have.

This is not failure to capture, as a pacemaker cannot produce ventricular depolarization (or a captured beat), during the refractory period. We would not expect capture for these spikes.

Note the short interval after the 3rd QRS before the captured pacemaker impulse appears (it looks exactly like the next 2 where the spike is more obvious). If a pacemaker spike appears earlier than the programmed ventricular escape interval, the pacemaker has failed to sense the native beat.

Recall that a VVI (or demand pacemaker) is designed to fire at a precise timing interval (the ventricular escape interval). The ventricular escape interval is set by the pacemaker rate (e.g., increasing the rate will shorten the distance between pacemaker beats). If a VVI pacemaker recognizes a native beat appropriately, it inhibits the pacemaker impulse and resets its timing clock to start the next ventricular escape interval from the native beat. Thus, a pacemaker spike should not occur after a native beat at an interval shorter than the ventricular escape interval.

An easy way to determine the expected ventricular escape interval is to find 2 consecutive paced beats and measure the distance from spike to spike. The interval is highlighted below by the arrows. If a paced beat *that follows a native beat* has a ventricular escape that is shorter than this distance, the pacemaker has inappropriately fired too soon. This indicates that it didn't recognize the native beat.

Sensitivity is the minimum myocardial voltage that is required before the pacemaker can recognize myocardial activity. A VVI pacemaker can only sense ventricular activity (versus an atrial or dual chamber pacemaker). The myocardial voltage is detected by the pacemaker electrode (not the ECG) and is determined by adjusting the millivoltage of the sensitivity setting.

A pacemaker setting of 4 mV (as in this example) means that the pacemaker will only recognize a native beat if the myocardial voltage is at least 4 mV high. If the myocardial voltage is lower than the pacemaker setting, the pacemaker acts as though the native beat did not occur and fires even though the native beat actually happened.

To correct this, the sensitivity needs to be increased (turning the sensitivity setting clockwise). Increasing the sensitivity lowers the sensitivity value (lower number in mV). This makes the pacemaker capable of detecting myocardial voltage that isn't as strong.

Other ways to determine the ventricular escape interval which helps to identify problems with sensing:

Recall that you can calculate heart rate from an ECG strip by dividing the number of small boxes between two beat into 1500.

In this example, there are approximately ~22 small boxes between consecutive pacemaker spikes. By dividing 1500 / 22, the pacemaker rate can be identified as ~68 beats per minute.

You can reverse equation to determine the ventricular escape interval if you know the pacemaker rate as follows (this example is for a pacemaker rate of 70):

Ventricular escape interval (number of small boxes) = 1500 / 70 = 21.42 small boxes (or .86 milliseconds)

Note: Some pacemakers have built in delay after a native beat. This may make the ventricular escape interval that precedes the first paced beat appear a bit longer than expected. This delay gives the patient's own rhythm a chance to kick in.

Case 1: Question 5

Blueprint Competency Being Tested: 3.4l

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: assisting with medical interventions (e.g., tracheostomy, intubation, chest tube insertion).

5. Mr. Jackle has a right chest tube inserted for a large pneumothorax. Immediately following insertion, the nurse notes that there is no fluctuation or bubbling in the underwater seal. Which one of the following interventions is the priority?

a. Increase the level of suction
b. Increase the volume in the water seal
c. Strip the chest tube
d. Obtain a STAT chest X-ray

ANSWER D

Rationale for Correct Response:

A chest tube that is successfully placed to resolve a pneumothorax should fluctuate (indicated it is patent and in the pleural space) and bubble (indicating it is evacuating the pneumothorax). The lack of fluctuation and bubbling from the onset of insertion indicates the tube is not in the proper position. The physician should be notified and a chest X-ray done to confirm correct placement. The patient should also be watched for signs of tension pneumothorax development/deterioration.

End of Case 1

CASE 2

Mr. Mohammad is an 18 yr old man who was struck by a baseball bat in the left temple while playing baseball. He sustained a depressed skull fracture and is started on a Dopamine infusion to increase his BP.

Case 2: Question 1

Blueprint Competency Being Tested: 1.3e

Recognizes actual or potential life-threatening alterations in neurological function, including: intracranial hypertension (e.g., traumatic brain injury, hepatic failure, stroke, herniation).

6. On his way to the CT scanner, Mr. Mohammad's left pupil suddenly becomes fixed and dilated. Which one of the following problems is consistent with these findings?

a. Epidural hematoma with compression of CN V
b. Pupillary dilation secondary to dopamine administration
c. Left mass effect with tentorial herniation
d. Bleeding from the ophthalmic artery

ANSWER C

Rationale for Correct Response:

Fixation and dilation of a pupil (if new and acute) suggests compression of CN III (oculomotor) on the same side as the dilated pupil (left in this example). This would be consistent with a mass lesion (caused by the epidural hematoma) on the left side. CN III sits at the top of the brainstem at the opening of the tentorium. The tentorium is the dural fold (membrane) that separates the cerebrum and cerebellum horizontally toward the back, and above the anterior basal skull at the front.

When a left cerebral mass (hematoma in this case) expands, it can herniate through the tentorium, pressing on structures located near the tentorial opening or top of the brainstem. Herniation through the tentorium will usually cause a loss of CN III function on the same side. CN III is responsible for pupillary constriction to light, for eyelid opening and for all eye movement except horizontally toward the temple (CN VI function) and downward rotation of the eye toward the nose (CN IV). Thus, CN III

compression causes the pupil to dilate and become non-responsive to light, the eye lid to be closed and the eye to lose the upward gaze (leaving it rotated "down and outward").

CN V is responsible for facial sensation and sits below the tentorium. In a comatose patient, loss of the corneal reflex indicates dysfunction of the CN V and VII reflex.

Dopamine can cause pupillary dilation but it would be bilateral. CN V (trigeminal) is responsible for sensation to the face and cornea, and for activating the muscles of mastication. It sits lower in the brainstem than CN III. In a comatose patient, loss of the corneal reflex indicates dysfunction of the CN V and VII reflex. Total blindness in the involved eye due to optic nerve damage (CN II) would is associated with disruption of the ophthalmic artery.

Case 2: Question 2

Blueprint Competency Being Tested: 1.5c

Selects the appropriate evidence-informed nursing interventions to correct alterations in cerebral tissue perfusion, such as: administering pharmacological agents (e.g., diuretics, barbiturates, analgesics, sedatives, neuromuscular blocking agents, steroids, vasopressor).

7. Which pharmacological agent would you anticipate as the first treatment for Mr. Mohammad's raised intracranial pressure with a BP of 180/55 and HR 45?

a. Dobutamine (Dobutrex)
b. Nimodipine
c. Hypertonic saline
d. Atropine

ANSWER C

Rationale for Correct Response:

Hypertonic saline is an osmotic diuretic that is used to reduce cerebral edema. It supports blood pressure better than mannitol. Mannitol would also be an appropriate option.

Nimodipine is a calcium channel blocker used to relax cerebral blood vessels and is used to minimize the impact of vasospasm following subarachnoid hemorrhage. Dobutamine might be used to augment the cardiac output for cerebral vasospasm, but it is not indicated in this scenario. The bradycardia with hypertension is suggestive of brainstem herniation; the treatment should be geared to lowering the ICP and cerebral diuretics are the priority.

Case 2: Question 3

Blueprint Competency Being Tested: 1.5d

Selects the appropriate evidence-informed nursing interventions to correct alterations in cerebral tissue perfusion, such as: managing invasive intracranial pressure monitoring or ventricular drainage devices (e.g., set-up, drainage, troubleshooting, positioning of device).

8. Mr. Mohammad undergoes an emergency craniectomy and insertion of an external ventricular drain (EVD). When zeroing the intracranial pressure monitoring system, what landmark will you use?

a. Mid axillary line
b. Base of occiput
c. External auditory meatus
d. Cleft of chin

ANSWER C

Rationale for Correct Response:

Acceptable landmarks include Foramen of Monro (channel between the lateral and third ventricle), midpoint between outer aspect of eyebrow and tip of ear (which is the theoretical landmark for the Foramen of Monro) or external auditory meatus or tragus (used in some centres as an easy to locate reference that is close to the catheter tip).

Case 2: Question 4

Blueprint Competency Being Tested: 3.4k

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: recognizing the need for changes to ventilator support (e.g., oxygenation, tidal volume, PEEP, mode).

9. Mr. Mohammad develops ARDS with worsening hypoxemia, with SpO_2 of 85% on FiO_2 0.8 PEEP 5 cm H_20 and AC 14 (set rate). Which one of the following interventions is a priority?

a. Increase his FiO_2 to 1.0 and accept SpO_2 of 90%
b. Increase the level of PEEP and monitor ICP
c. Initiate low tidal volume ventilation
d. Prepare for urgent bronchoscopy

ANSWER B

Rationale for Correct Response:

ARDS is associated with intrapulmonary shunting due to alveolar volume loss. Hypoxemia on 80% oxygen indicates significant shunting, which will necessitate the use of PEEP to reopen areas of collapse. Although there is concern that high levels of PEEP can increase intracranial pressure, this generally only occurs if the level of PEEP is causing overdistention of alveoli with central venous compression. PEEP at levels that are just high enough to reopen collapsed alveoli are less likely to raise the ICP. Because Mr. Mohammad has an ICP monitor, you can titrate the PEEP level to the blood oxygen level while monitoring for adverse events (e.g., increase in ICP). Hypoxia causes secondary brain injury and leaving it untreated would be more deleterious than an increase in the PEEP.

Prolonged use of high oxygen levels and inadequate PEEP may cause worsening lung injury. Hypoxemia is a serious threat to the injured brain. Without appropriate treatment it can cause secondary injury with increased ICP. An SpO2 of 90% is too low in an acutely brain injured patient.

Low tidal volume ventilation is associated with higher PCO_2 levels, which can increase the ICP and cause secondary injury. Low tidal volumes may also worsen the hypoxemia if introduced before the PEEP is increased. Once the oxygenation is stabilized, low tidal volume ventilation should only be considered if it can be introduced without raising the PCO_2 above 40 mmHg in the setting of acute intracranial hypertension.

Case 2: Question 5

Blueprint Competency Being Tested: 10.3a

Understands criteria for: determination of neurological death and/or cardiac death.

10. Mr. Mohammad's condition deteriorates and he no longer responds to stimulation. Which one of the following lab tests is mandatory to confirm Neurological Determination of Death (NDD)?

a. PaO_2
b. Lactate
c. $PaCO_2$
d. Ammonia

ANSWER C

Rationale for Correct Response:

Apnea must be present to confirm neurological death (in addition to absence of any other brain function or metabolic causes, and in the setting of normothermia). Apnea indicates that the lowest portion of the brainstem (medulla) has stopped working. To confirm apnea, breathing must be absent despite a documented stimulus (high carbon dioxide level).

End of Case 2

Blueprint Competency Being Tested: 7.7d

Selects appropriate evidenced-informed nursing interventions to prevent or correct alterations in the hematologic system including: hemorrhagic disorders (e.g., hemophilia).

11. Mr. Sing has a massive GI bleed. Following transfusion of packed red blood cells and plasma, he has the following labs: Hgb 80 g/L Platelets 82,000 INR 1.9 aPTT 58 seconds and fibrinogen 0.4 g/L (normal 2-4 g/L). Which one of the following interventions is indicated?

a. Potassium bolus
b. Prothrombin Complex Concentrate (PCCs) (e.g., Octaplex™ or Beriplex™)
c. Cryoprecipitate
d. Protamine sulphate

ANSWER C

Rationale for Correct Response:

Cryoprecipitate contains fibrinogen concentrate (from multiple donor), factors VII and VIII in concentrations higher than fresh frozen plasma. This fibrinogen is critically low, most likely due to excessive consumption and administration of a large amount of red blood cells without plasma.

Potassium will usually rise following multiple blood products and calcium may be low due to citrate contained in the blood products. Additional fresh frozen plasma, packed cells (if bleeding has not resolved) and platelets may be required, and Factor VII administration may also be considered.

Prothrombin Complex Concentrates (PCCs) contain concentrated Vitamin K dependent clotting factors (Factors II, VII, IX, X, Protein C and Protein S). PCCs are only indicated for high INR due to Coumadin therapy if urgent reversal (due to bleeding or pending procedure) is needed.

PCCs are provided by Canadian Blood Services as either Beriplex™ or Octaplex™. Both contain both citrate and heparin (cannot be given if patient has HITT syndrome).

Blueprint Competency Being Tested: 7.1b

Interprets data (initial and ongoing assessment or response to interventions) related to the immunologic and hematologic systems, including: laboratory results related to immunology and inflammation (e.g., complete blood count [CBC], neutrophils, leukocytes, lymphocytes, bands, immunoglobulins, cultures: bacterial, viral and fungal).

12. Mrs. Butovsky develops sepsis due to an infected prosthetic hip joint. She is started on antibiotic therapy. Which lab test can be used to evaluate her response to antibiotic therapy?

a. Erythrocyte Sedimentation Rate (ESR)
b. Protein C levels
c. C-Reactive Protein
d. Ionized calcium levels

ANSWER C

Rationale for Correct Response:

C-Reactive protein is an acute phase protein that increases during acute inflammation. It binds to the surface of dead or dying cells and to some bacteria, to activate the complement cascade. Although it is non specific and does not identify the cause of the rise (like ESR), it decreases quickly following resolution of inflammation (unlike ESR which remains elevated for a prolonged period of time), making it a useful marker to identify resolution of inflammation or infection (particularly in joint infections or acute coronary syndromes).

Blueprint Competency Being Tested: 1.1b

Interprets data (initial and ongoing assessment or response to interventions) related to the neurological system), including: laboratory results (e.g., osmolality, cerebral spinal fluid [CSF], sodium, arterial blood gases [ABGs], glucose).

13. When administering mannitol for raised ICP, which one of the following lab test should be followed as a priority?

a. Serum arginine vasopressin (AVP)
b. Urine specific gravity
c. Serum creatinine
d. Serum osmolality

ANSWER D

Rationale for Correct Response:

Mannitol is given to promote osmotic diuresis and reduce cerebral edema. Repeated dosing can cause excessive volume contraction. Osmolality should be measured with regular mannitol dosing. A serum osmolality > 320 mmol/L should be reviewed with the physician.

Blueprint Competency Being Tested: 2.1d

Interprets data (initial and ongoing assessment or response to interventions) related to the cardiovascular system, including: 12-lead ECG (e.g., ischemia, infarction, bundle branch blocks).

14. Following cardiac surgery, Mr. Cassanza is noted to have new 2-3 mm ST segment elevation in Leads I, II, III, aVF, aVL and V5-V6. Which one of the following conditions is most likely associated with these findings?

a. Left ventricular hypertrophy
b. ST elevation myocardial infarction
c. Pericarditis
d. Pulmonary embolus

ANSWER C

Rationale for Correct Response:

The pericardium is dissected during cardiac surgery; pericarditis is a common post-op phenomenon. ST elevation across all leads (especially in leads I, II, III, aVF, aVL and V5-V6) is suggestive of pericarditis. MI is localized to specific walls of the heart, based on the area supplied by an occluded vessel. ST elevation associated with MI is limited to the leads that look at the zone of injury/infarction.

Pulmonary embolus is rare post cardiac surgery due to intra-operative anticoagulation and would be identified by a right ventricular strain pattern on ECG. This may be identified by an S1Q3T3 (S wave in Lead I, Q wave in Lead 3 and inverted T wave in Lead 3). Left ventricular hypertrophy is identified by any one of the following: R wave height > 11 mm in aVL, total R wave height in Lead I + S wave depth in Lead III = 25 mm and S wave depth in V1 + R wave height in V5 = > 35 mm.

Blueprint Competency Being Tested: 3.3h

Recognizes an actual or potential life-threatening alteration of the respiratory system: chronic pulmonary disease (e.g., restrictive, obstructive).

15. Mr. Topias was admitted two days ago following emergency surgery for an ischemic bowel. He is hemodynamically stable, but has failed a spontaneous breathing trial. On chest X-ray, his lungs are hyperinflated with interstitial disease and his chest appears barrel shaped. Which of the following data would be most helpful?

a. Total lung capacity
b. Minute volume
c. Preadmission FEV1/FVC
d. Peak Negative Inspiratory Pressures

ANSWER C

Rationale for Correct Response:

Hyperinflation and barrel chested appearance suggest emphysema, while interstitial patterns could indicate either acute or chronic lung problems. Optimization of respiratory function may be required to facilitate liberation from the ventilator. FEV1/FVC ratio is the best test to differentiate restrictive from obstructive (e.g., emphysema) disease. Peak negative inspiratory pressures are difficult to obtain and often unreliable in a ventilated patient.

Blueprint Competency Being Tested: 3.3g

Recognizes an actual or potential life-threatening alteration of the respiratory system: inhalation injuries (e.g., thermal, carbon monoxide, aspiration).

16. Mrs. Zena was admitted with 30% full thickness burns to the back and side of her head following a house fire. Her carboxyhemoglobin level is 35%, SpO_2 100% and PaO2 85 mmHg. Which one of the following is the immediate priority?

a. 100% oxygen therapy
b. Intubation with PEEP
c. Non-invasive ventilation
d. Diuretics

ANSWER A

Rationale for Correct Response:

100% oxygen is a priority for any patient with possible smoke or carbon monoxide poisoning and should be initiated immediately. Carboxyhemoglobin is a measure of the percentage of carbon monoxide bound to hemoglobin and is normally 0.01 or less. A level of 0.35 (35%) indicates a maximum capacity for oxyhemoglobion (oxygen saturation) of 65%. Carbon monoxide has an affinity for hemoglobin that is 210 times greater than oxygen. To prevent carbon monoxide from "beating out oxygen for hemoglobin binding sites", the PaO2 must be increased with 100% oxygen to help "push carbon monoxide" off hemoglobin and allow oxygen to bind preferentially. The goal is to push the PaO2 as high as possible (500-600 would be normal lungs).

Saturation probes cannot reliably differentiate oxyhemoglobin from carboxyhemoglobin, therefore the SpO2 of 100% may overestimate the true oxyhemoglobin. The carboxyhemoglobin level of 35% suggests an overestimation by the pulse oximeter. An inspired oxygen of 100% should be continued until the carboxyhemoglobin is normalized. Although intubation may also be indicated, 100% oxygen is the first intervention or priority.

Blueprint Competency Being Tested: 3.4d

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: managing the endotracheal tube or tracheostomy (e.g., suctioning, tube placement, tracheobronchial toilet).

17. Immediately following intubation, Mrs. Livert has an end tidal CO_2 reading of 1 mmHg. Which one of the following explanations is consistent with these findings?

a. Presence of a pulmonary embolus
b. The endotracheal tube is in the right mainstem bronchus
c. Effective ventilation using a manual resuscitation bag
d. The endotracheal tube is in the esophagus

ANSWER D

Rationale for Correct Response:

End tidal CO_2 reflects the amount of carbon dioxide in the airway at the end of exhalation. It should equilibrate with the carbon dioxide level in the blood. The absence (or near absence) of carbon dioxide indicates the tube is not in the airway.

Blueprint Competency Being Tested: 3.1d

Interprets data (initial and ongoing assessment or evaluating results of interventions) related to the respiratory system, including: oxygen value (e.g., PaO2, SaO2, SpO2, oxygen content, PaO2/FiO2 ratio).

18. Which one of the following options identifies the components of Arterial Oxygen Content (CaO_2).

a. Hb, $Sa0_2$, cardiac output
b. Hb, $Pa0_2$, $Sa0_2$
c. Hb, $Scv0_2$, cardiac output
d. Hb, $Sa0_2$, $Sv0_2$

ANSWER B

Rationale for Correct Response:

The formula for oxygen content (the total number of oxygen molecules in the blood) is:

Arterial Oxygen Content: ($Hb \times 1.36 \times SaO_2$) + ($0.003 \times PaO_2$)

Blueprint Competency Being Tested: 1.1d

Interprets data (initial and ongoing assessment or response to interventions related to the neurologic system), including: cerebral perfusion pressure (e.g., calculations).

19. Calculate Cerebral Perfusion Pressure (CPP) based on the following data:

HR 75
BP 140/80 (MAP 100)
CVP 12
ICP 15
RR 25
Minute Volume 10.5 L/min

a. 65
b. 85
c. 125
d. 60

ANSWER B

Rationale for Correct Response:

Cerebral Perfusion Pressure = MAP – ICP (100-15=85).

Blueprint Competency Being Tested: 10.4

Selects appropriate evidence-informed nursing interventions to provide care in preparation of organ donation (e.g., maintaining hemodynamic stability, comfort care, symptom relief, diagnostic testing).

20. Neurological determination of death has been confirmed with Mr. Alberta. His family consents to organ donation. Which one of the following interventions is the priority?

a. Vasopressin, Methylprednisolone (Solumedrol) and Levothyroxine
b. Antibiotics, Vasopressin and intensive Insulin
c. Desmopressin (DDAVP), Epinephrine and Dexamethasone (Decadron)
d. Antibiotics, Immunoglobulin and Vasopressin

ANSWER A

Rationale for Correct Response:

Hypothalamic dysfunction occurs following brain death. Antidiuretic hormone deficiency (diabetes insipidus) is a recognized consequence of severe brain injury. Deficiencies of other hormones within the hypothalamus-pituitary control have also been identified, including thyroid and cortisol. Antidiuretic hormone, thyroid and cortisol hormones all play an important role in hemodynamic stability and cardiac function. Consequently, all three of these hormones are now given to solid organ donors to enhance the success rate of the donated organs. These 3 hormones are referred to as “triple H therapy” (triple hormone).

Blueprint Competency Being Tested: 2.3a

Intervenes based on observation of manifestations of the following actual or potential life-threatening alterations in cardiac output and perfusion: cardiogenic shock (e.g., myocardial infarction, cardiomyopathy).

21. Mr. Smith is admitted with pulmonary edema requiring intubation. Two hours after admission his cardiac troponin has increased 5 fold, he develops new ST segment depression in his lateral leads and his blood pressure drops to 75/50. Which one of the following interventions is the priority?

a. Tenecteplase (TNKase)
b. IV Heparin
c. Metoprolol (Betaloc)
d. Morphine

ANSWER B

Rationale for Correct Response:

These findings are consistent with an Acute Coronary Syndrome or Non-ST Elevation MI (NSTEMI). IV heparin is an example of an appropriate intervention (other appropriate agents include Acetylsalicylic acid, other anticoagulants such as Fondaparinux (low molecular weight heparins should be used with caution with renal insufficiency) or platelet inhibitors [such as glycoprotein inhibitors or Plavix].

Tenecteplase and Alteplase are both examples of tissue plasminogen activators (tPA) that act as fibrinolytic agents (clot busters). Fibrinolytics are only indicated in MI for ST Segment Elevation MI (STEMI) or MI with new Left Bundle Branch Block (not NSTEMI).

Percutaneous Coronary Intervention (PCI) is now the preferred treatment over fibrinolytic therapy for most STEMIs, providing that balloon inflation can be achieved within 90 minutes (or 120 minutes if transportation to an interventional center is required). If PCI is not an option, fibrinolytic agents should still be considered and given as early as possible (ideally within 30 minutes). If the onset of pain is > 90 minutes, fibrinolytics can be considered up to 12 hours post symptom onset.

The blood pressure is too low for initiation of a beta blocker or Morphine at this time.

Blueprint Competency Being Tested: 2.6a

Selects appropriate evidence-informed nursing interventions to correct alterations in cardiac output, such as: optimizing preload (e.g., fluid administration, pharmacological agents).

22. Mr. Viato had an open repair of an abdominal aneurysm. His fluid balance from the operating room is 2 liters positive and he is on FiO2 0.4 PEEP 10 and AC 14. Three hours following admission, his urine output is 25 ml/hr, CVP 12, HR 110 and BP 90/60. Which one of the following interventions is the priority?

a. Furosemide (Lasix)
b. Fluid
c. Beta blockers
d. Dobutamine (Dobutrex)

ANSWER B

Rationale for Correct Response:

The first priority for decreased urine output, hypotension and tachycardia is fluid. A CVP of 12 in a ventilated patient is difficult to interpret and does not necessarily indicate adequate intravascular volume. A fluid bolus with careful assessment of response to therapy is warranted.

This patient has already experienced impaired renal blood flow intraoperatively and hypovolemia would increase the potential for prerenal injury. Acute resuscitation should err on the side of volume replacement unless there has been no response to a fluid challenge. The positive fluid balance from the operating room often underestimates the actual operative losses (particularly in the setting of a ruptured aneurysm). As well, large third space shifts and postoperative fluid requirements should be expected with major vascular and abdominal surgeries.

If no improvement is demonstrated during the rapid administration of fluid, vasoactive agents should be considered to avoid fluid overload.

Blueprint Competency Being Tested: 3.4k

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: recognizing the need for changes to ventilatory support (e.g., oxygenation, tidal volume, PEEP, mode).

23. Mrs. Evans becomes more difficult to ventilate and her chest X-ray reveals worsening bilateral infiltrates. Her oxygen saturation falls to 80% despite an FiO2 1.0 and PEEP 18. Which one of the following interventions may help to improve her hypoxemia?

a. Lung Recruitment Manoeuver
b. Low tidal volume ventilation
c. Bronchoscopy
d. Manual bagging and suctioning

ANSWER A

Rationale for Correct Response:

There are a number of strategies that may be tried to treat refractory hypoxemia that is due to alveolar derecruitment (as in ARDS). On an individual patient basis, any of these strategies may be successful, however, there are no randomized controlled trials to show that any of these strategies save lives overall. Examples of strategies that may be tried include: recruitment maneuvers, diuretics, prone positioning, nitric oxide or other pulmonary vasodilators or even paralytic agents. Ventilation strategies to increase oxygenation include modalities that increase the mean airway pressure to open up alveoli and keep them inflated. Examples of ventilation modalities that increase the peak airway pressure include: Bi Level modes (that include high and low PEEP), increased inspiratory:expiratory ratios and Airway Pressure Release Ventilation.

Although Low Tidal Volume ventilation has been shown to improve patient survival, it does not improve oxygenation (if used without enough PEEP it can lead to derecruitment and worsening of the PO_2).

There is no indication for bronchoscopy (the X-ray did not reveal a collapse). Disconnection of the PEEP to perform manual bagging could cause the patient to decompensate by derecruitment of alveoli.

Blueprint Competency Being Tested: 2.2

Understands the rationale for and clinical implications and complications of 15-lead ECG, transesophageal echocardiogram [TEE], transthoracic [2-D echocardiogram], intra-aortic balloon pump and pressures, percutaneous coronary intervention [PCI].

24. Identify a complication specific to the use of an Intra-Aortic Balloon Pump.

a. Impaired R arm circulation
b. Thrombocythemia (thrombocytosis)
c. Deep Vein Thrombosis
d. Acute kidney injury

ANSWER D

Rationale for Correct Response:

If the balloon is too low, it can compromise renal blood flow.

If the balloon is too high, it can compromise flow to the left subclavian artery and the LEFT arm. The risk for DVT is the same as for other critically ill patients on bedrest. Thrombocythemia is an increase in platelet count; platelet counts usually decline because of the presence of a foreign vascular body.

Blueprint Competency Being Tested: 2.5c

Selects appropriate evidenced-informed nursing interventions to correct alterations in cardiovascular perfusion, such as: administering inotropes.

25. Which one of the following agents has inotropic properties?

a. Epinephrine (Adrenalin)
b. Metoprolol (Betaloc)
c. Diltiazem (Cardizem)
d. Ramipril (Altace)

ANSWER A

Rationale for Correct Response:

Epinephrine stimulates beta inotropic receptors to increase contractility. Metoprolol and Diltiazem decrease contractility by beta and calcium blockade respectively. Ramipril may indirectly improve contractility but it is an ACE inhibitor that causes mild afterload reduction and sodium/water elimination.

Blueprint Competency Being Tested: 3.4f

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: pharmacological agents to facilitate ventilation (e.g., analgesics, reversal agents, sedatives, paralytics, puffers/aerosol therapy)

26. Mrs. Haberdeen is admitted with exacerbation of COPD following an influenza like illness. She has increased sputum production and cough, with loud expiratory wheezes despite the increased use of bronchodilators at home. Her blood gases on room air are:

PaO_2	48
$PaCO_2$	58
pH	7.36
HCO_3	40
BE	+10

Which intervention is the priority?

a. Bilevel non-invasive ventilation
b. Prednisone
c. Mechanical ventilation
d. Acetylcysteine (Mucomyst)

ANSWER B

Rationale for Correct Response:

Steroids and antibiotics are indicated for the treatment of COPD exacerbation.

These gases are compensated (normal pH), suggesting chronic CO_2 retention with bicarbonate compensation. Bicarbonate compensation takes many hours to achieve; the presence of a high bicarbonate on admission is consistent with chronic compensated hypercarbia. Although her condition could deteriorate, ventilation support with non-invasive or invasive ventilation is not presently indicated.

Her PaO_2 is lower than expected for a hypoxic drive. The first step for correcting the PaO_2 would be to initiate oxygen by nasal prongs at 1 L and titrate until the SpO2 is 88-91%. Although oxygen therapy is definitely indicated, it is not among the options available.

Be aware of question on the exam that may not have an option you want but are attempting to address a different competency (such as pharmacological intervention in this case).

Blueprint Competency Being Tested: 1.1a

Interprets data (initial and ongoing assessment or response to interventions related to the neurologic system), including: physical assessment (e.g., vital signs, level of consciousness, Glasgow Coma Scale, sedation scale, cranial nerve assessment, delirium assessment, pain assessment, motor and sensory assessment, pupils, peripheral nerve stimulation [TOF]);

27. Mr. Vera suffered a right hemispheric stroke. He does not open his eyes, extends his left arm and makes grunting sounds to central pain. He is pulls at his urinary catheter with his right hand. What is his score on the Glasgow Coma Scale?

a. 5
b. 7
c. 8
d. 9

ANSWER C

Rationale for Correct Response:

1 (eye opening); 2 (verbal); 5 (motor). Purposeful movement (trying to remove something that is noxious) is localization with his right hand. Choose the best response for each category.

Blueprint Competency Being Tested: 2.3g

Intervenes based on observation of manifestations of the following actual or potential life-threatening alterations in cardiac output and perfusion: hypertension (e.g., post cardiovascular surgery, pheochromocytoma, pregnancy induced);

28. Mrs. Ploutette is admitted with a hypertensive crisis. Her BP is 240/190 with a HR of 120. Which one of the following interventions would you anticipate?

a. Labetolol (Trandate)
b. Nitroglycerine
c. Phenylephrine (Neosynephrine)
d. Isoproterenol (Isuprel)

ANSWER A

Rationale for Correct Response:

Labetolol is an antihypertensive agent that also lowers heart rate. It works by blocking both alpha and beta receptors. Nitroglycerine can produce a mild reduction in blood pressure, however, it is a better venous dilator. A BP this high would need a drug that has better arterial vasodilating effects.

Blueprint Competency Being Tested: 3.1b

Interprets data (initial and ongoing assessment or evaluating results of interventions) related to the respiratory system, including: laboratory results (e.g., arterial blood gases [ABGs], methemoglobins, carboxyhemoglobins).

29. Interpret the following blood gas.

PaO_2	78
$PaCO_2$	29
pH	7.29
HCO_3	14
BE	- 10

a. Respiratory alkalosis
b. Respiratory acidosis
c. Metabolic alkalosis
d. Metabolic acidosis

ANSWER D

Rationale for Correct Response:

Metabolic acidosis (pH and bicarbonate are both acidotic).

Blueprint Competency Being Tested: 2.6f

Selects appropriate evidence-informed nursing interventions to correct alterations in cardiac output, such as: managing a cardiac arrest (e.g., advanced cardiac life support [ACLS] protocols, therapeutic hypothermia).

30. Mr. Yablonski is awaiting transfer to the ward and is no longer on the bedside monitor. The nurse enters his room to assess him, and finds him cyanotic, apneic and pulseless. Which one of the following is the priority?

a. Bag mask ventilation
b. Compressions
c. Epinephrine
d. Defibrillation

ANSWER B

Rationale for Correct Response:

New guidelines published in 2010/2015 emphasize high quality CPR using a CAB priority (Circulation-Airway-Breathing).

Defibrillation should be performed after completion of 2 minutes of CPR with one quick shock. Following the shock, 2 more minutes of CPR should be provided.

Blueprint Competency Being Tested: 9.5d

Selects appropriate evidence-informed nursing interventions to promote comfort, such as: delirium prevention (e.g., manipulation of the environment, promoting sleep, pharmacological agents, consideration of causes).

31. Mrs. Habernathy becomes agitated and is at risk for self-exubation. Which one of the following interventions is the priority?

a. Apply restraints
b. Assess cause of agitation
c. Increase dose of sedatives
d. Have family sit with Mrs. Habernathy

ANSWER B

Rationale for Correct Response:

Agitation can be caused by a variety of problems such as delirium, pain, anxiety or constipation. An assessment should always be conducted to ensure that treatment options are geared toward the underlying cause, as the wrong treatment may worsen the agitation. A least restraint policy should be utilized; restraints should only be used following a thorough assessment and after attempts at other interventions fail.

Blueprint Competency Being Tested: 2.3c

Intervenes based on observation of manifestations of the following actual or potential life-threatening alterations in cardiac output and perfusion: distributive shock (e.g., systemic inflammatory response system [SIRS], sepsis, neurogenic shock, anaphylactic shock).

32. Mrs. Fortein is admitted with urosepsis. Her blood pressure is 85/40 with a heart rate of 125 following 4 L of crystalloid. She remains oliguric with a urine output of < 10 ml/hr. Which one of the following interventions is indicated?

a. Steroids
b. Dopamine (Intropin)
c. Norepinephrine (Levophed)
d. Dobutamine (Dobutrex)

ANSWER C

Rationale for Correct Response:

These findings indicate sepsis with organ dysfunction despite fluid resuscitation. A vasopressor should be added next; norepinephrine is the preferred agent in septic shock as it produces vasoconstriction, and usually lowers HR. HR is too high for Dopamine and Dobutamine is a vasodilator. Steroids may be indicated in septic shock but only if vasopressor dependent.

Blueprint Competency Being Tested: 7.7c

Selects appropriate evidenced-informed nursing interventions to prevent or correct alterations in the hematologic system including: consumptive coagulopathy (e.g., disseminated intravascular coagulopathy [DIC], heparin-induced thrombocytopenia [HITT).

33. Mrs. Green is on Coumadin for atrial fibrillation. She is admitted with ischemic bowel and requires urgent surgery. Her INR is 10.4 and aPTT 52 seconds. Which one of the following interventions is the priority?

a. Protamine sulphate
b. Prothrombin Complex Concentrate (PCC) (e.g. Octaplex™ or Beriplex™)
c. Cryoprecipitate
d. Vitamin K infusion

ANSWER B

Rationale for Correct Response:

Coumadin blocks the production of Vitamin K dependent clotting factors. Prothrombin Complex Concentrates (PCCs) provide concentrated levels of Factors II, VII, IX, X and Protein C and S, the factors that are blocked by Coumadin. Vitamin K is never administered by infusion. While a dose of Vitamin K may be ordered, it would be given in conjunction with the immediate antidote which is the Prothrombin Complex Concentrate (PCC). Beriplex™ and Octaplex™ are the two examples of PCCs provided by Canadian Blood Services.

Blueprint Competency Being Tested: 7.8

Identifies infection control risks to patients, families and interprofessional team and takes necessary preventive measures to protect against exposure (e.g., personal protective equipment [PPE], negative pressure room).

34. Ms. Tabuski is admitted with septic shock related to meningococcal meningitis. Which one of the following precautions should be instituted?

a. Airborne precautions
b. Contact precautions
c. Droplet precautions
d. Routine precautions

ANSWER C

Rationale for Correct Response:

The mode of transmission for meningococcal meningitis is droplet or direct contact, therefore, droplet precautions should be applied. http://www.phac-aspc.gc.ca/msds-ftss/msds109e-eng.php

Blueprint Competency Being Tested: 8.3a

Recognizes actual or potential life-threatening alterations of the musculoskeletal and integumentary systems, such as: compartment syndrome (e.g., abdominal, limb).

35. Six hours following a motor vehicle collision, Mr. Kibble has a 10-fold increase in his CK. Which one of the following interventions is the priority?

a. IV Fluids
b. Furosemide (Lasix)
c. Tissue plasminogen activator (tPA)
d. Insulin and glucose

ANSWER A

Rationale for Correct Response:

High CK indicates muscle injury due to trauma. The first priority is to maintain a high urine output with fluid. Lasix may become necessary if the patient develops a positive balance after fluid loading, but the initial treatment is to augment intravascular volume with fluid to promote "flushing of the CK and inflammatory substrates from the kidney". Insulin and glucose would only be indicated if hyperkalemia developed.

Blueprint Competency Being Tested: 4.2a

Recognizes actual or potential life-threatening alterations to the gastrointestinal system, including: ischemic disorders (e.g., infarcted bowel, hepatic failure, cirrhosis, abdominal compartment syndrome).

36. Following open repair of a ruptured aneurysm, Mr. Gregson's bladder pressure is 45 mmHg. Which one of the following interventions is the priority?

a. Continuous bladder irrigation
b. Surgical consultation
c. Decrease the amount of PEEP
d. Continuous renal replacement therapy

ANSWER B

Rationale for Correct Response:

A bladder pressure of 45 mmHg is consistent with abdominal compartment syndrome. Increasing intraabdominal pressures can develop following major abdominal surgeries as a result of intra-abdominal edema. Rising pressures compress against gut organs, causing GI and renal ischemia, decreased venous return and cardiac output and ventilator failure. While interventions to temporarily improve perfusion can include fluid/vasopressor therapy or sedatives/paralytics to relax abdominal muscle resistance, intraabdominal compartment syndrome requires emergency surgical consultation to determine if an operative intervention is required.

Blueprint Competency Being Tested: 8.3b

Recognizes actual or potential life-threatening alterations of the musculoskeletal and integumentary systems, such as: burns (e.g., thermal, chemical, radiation, electrical).

37. Mr. Chen experiences full thickness circumferential burns to his chest, abdomen and back. Which one of the following interventions is the priority?

a. Silver sulfadiazine
b. Wound debridement
c. Topical analgesia
d. Escharotomies

ANSWER D

Rationale for Correct Response:

Full thickness burns create a leather-like non-stretchable skin surface. When burns are circumferential, the loss of compliance causes a compartment syndrome. In a limb, this can cause muscle death and rhabdomyolysis, while in the chest, it can prevent lung expansion. Escharotomies to cut through the dead tissue and relieve any compartment/chest wall restriction is a priority.

Blueprint Competency Being Tested: 2.3b

Intervenes based on observation of manifestations of the following actual or potential life-threatening alterations in cardiac output and perfusion: hypovolemic shock (e.g., hemorrhage, third space loss).

38. Six hours following a traumatic brain injury due to a fall from a ladder, Mr. Plueth develops hypotension and a 40 gram/L drop in hemoglobin. Which one of the following problems would be consistent with this drop in hemoglobin?

a. Diabetes insipidus
b. Intracranial hemorrhage
c. Intra-abdominal bleeding
d. Hemolysis

ANSWER C

Rationale for Correct Response:

Bleeding into the brain would not account for hypotension or a 40 gm drop in hemoglobin as there is not enough room in the cranial compartment to accommodate this much volume (brain death would occur).

Diabetes insipidus would not cause anemia (it is associated with volume contraction). Fat embolism would be associated with hypoxemia and respiratory distress; mild anemia can occur with thrombocytopenia, but not a 40 gm drop.

Missed injuries must always be suspected in trauma, and an unexplained drop in hemoglobin with hypovolemia/hypotension requires investigation to identify the source of bleeding. Intra-abdominal, thoracic, pelvic and femur injuries are the most common locations for hidden blood loss.

Blueprint Competency Being Tested: 1.3a

Recognizes actual or potential life-threatening alterations in neurologic function, including: ineffective thermoregulation (e.g., hyperthermia, hypothermia).

39. During surgery, Mrs. Zibert develops malignant hyperthermia. Which one of the following is the priority?

a. Aggressive cooling
b. Potassium boluses
c. Sodium citrate
d. Dantrolene sodium

ANSWER D

Rationale for Correct Response:

Dantrolene is the antidote for malignant hyperthermia. It disrupts the sustained muscle contractions, which causes hyperkalemia, fever, lactic acidosis and tetany. Cooling will not stop the process.

Blueprint Competency Being Tested: 8.3c

Recognizes actual or potential life-threatening alterations of the musculoskeletal and integumentary systems, such as: wounds (e.g., postoperative wounds, post trauma wounds, decubitus ulcers, necrotizing fasciitis).

40. Which one of the goals for wound care should be included for a Stage II pressure ulcer?

a. Wet to dry dressings
b. Hydrocolloid dressings
c. Cleansing with chlorhexidine
d. Tight packing of wound cavity

ANSWER B

Rationale for Correct Response:

Hydrocolloid dressings provide cost effective wound healing. Moist wound healing is the goal. Wet to dry causes disruption of new granulation tissue, may delay healing and increase pain. Wounds should be cleansed and irrigated with saline or ringers lactate; cleansers are not recommended. A stage II pressure ulcer is a shallow wound with a pink bed, packing is not indicated. In Stage III and IV, packing should be light.

Blueprint Competency Being Tested: 3.4k

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: recognizing the need for changes to ventilatory support (e.g., oxygenation, tidal volume, PEEP, mode).

41. Simone is a 22 year old woman admitted with ARDS following Influenza A. Her blood gases on FiO2 0.8 PEEP 10 PC 16 (tidal volumes ~400 cc) and set RR 28 are as follows:

PaO_2 52 $PaCO_2$ 46 pH 7.32 HCO_3 17

Which one of the following interventions is the priority?

a. increase PEEP
b. increase FiO_2
c. decrease PC
d. increase RR

ANSWER A

Rationale for Correct Response:

Her greatest problem is hypoxemia (she also has mild hypercarbia and mild metabolic acidosis). She is already on FiO_2 0.8 with persistent hypoxemia, indicating significant pulmonary shunting.

She needs her lung recruited with additional PEEP to increase the surface area for gas exchange. There would be little benefit (but increased harm) with higher oxygen concentrations. Lowering her tidal volume is an appropriate intervention (and could be achieved with a lower PC), however, without sufficient PEEP it could lead to worsening of her alveolar volume loss. Her PEEP should be increased to support her oxygen prior to reducing her tidal volume to the target level.

Blueprint Competency Being Tested: 1.1a

Interprets data (initial and ongoing assessment or response to interventions related to the neurologic system), including: physical assessment (e.g., vital signs, level of consciousness, Glasgow Coma Scale, sedation scale, cranial nerve assessment, delirium assessment, pain assessment, motor and sensory assessment, pupils, peripheral nerve stimulation [TOF]).

42. Which pair of cranial nerves is being evaluated when a corneal reflex test is performed on the L eye.

a. L CN V and CN VII
b. R CN III and CN VII
c. L CN III and CN VII
d. R CN V and CN VII

ANSWER A

Rationale for Correct Response:

Sensation to the cornea is provided by the trigeminal nerve (CN V). Specifically, it is provided through the upper division of CN V, referred to as the V1 branch. Through a brainstem reflex (independent of patient's wakefulness), stimulation of CN V will automatically stimulate CN VII (facial) to protect the eye by closing both eyelids.

The left CN V senses the L side of the face and stimulates the left CN VII to cause the entire left side of the face to move and left eyelid to close. CN VII also causes the eye to tear and the mouth to salivate.

Blueprint Competency Being Tested: 1.4b

Intervening in spinal cord crises: spinal shock, neurogenic shock, autonomic dysreflexia (e.g., alleviating cause, pharmacological agents, positioning, fluids).

43. Ms. Frederick sustained a complete spinal cord injury at the level of C3 and underwent anterior fixation 3 days ago. Which one of the following interventions should be included in her care plan?

a. Assisted cough during suctioning
b. Atropine pre suctioning
c. Mannitol x 24 hours postoperatively
d. Early extubation

ANSWER A

Rationale for Correct Response:

Spinal cord injury above ~T6 is associated with impaired cough and vital capacity (lack of abdominal muscles). Assisted cough is an important nursing intervention and should be combined with a supportive level of PEEP during mechanical ventilation and breath stacking when ready. An assisted cough is provided by a second provider, by the application of inward and upward diaphragmatic pressure during suctioning.

A complete injury at the level of C3 is usually associated with apnea and complete ventilator dependence.

Bradycardia can occur due to loss of autonomic nervous system control. It is usually induced by position changes or suctioning; atropine is only indicated if the bradycardia cannot be prevented or corrected with manual lung inflation/oxygen administration or repositioning.

Mannitol is not routinely used following surgery it would only be indicated if there was evidence of acute cord or cerebral edema. Early extubation would not be indicated; a cord injury at the Level of C3 is usually associated with loss of phrenic nerve stimulation. Anterior fixation is also associated with upper airway edema in the immediate postoperative period.

Blueprint Competency Being Tested: 3.5

Selects appropriate evidence-informed nursing interventions to promote return to spontaneous ventilation.

44. After failing several spontaneous breathing trials, Mrs. Pitre received a percutaneous tracheostomy tube. Two days later, within 10 minutes of starting a tracheostomy mask trial, she complains of shortness of breath and requests to return to the ventilator. Her SpO_2 remains > 95% during the trial. Which one of the following interventions pre-tracheostomy mask trial is most likely to reduce her dyspnea and facilitate spontaneous breathing?

a. N-acetylcysteine (Mucomyst)
b. Lorazepam (Ativan)
c. Morphine
d. Aminophylline

ANSWER C

Rationale for Correct Response:

Narcotics (and particularly Morphine) may be associated with dyspnea relief. If anxiety is the main cause of the wean issue, it may help to provide relaxation. There is no evidence for benefit of either Acetylcysteine or Aminophylline.

Blueprint Competency Being Tested: 7.7a

Selects appropriate evidenced-informed nursing interventions to prevent or correct alterations in the hematologic system including: venous thrombotic disorders: deep vein thrombosis (DVT), pulmonary thromboembolism, vascular access associated thrombosis;

45. Mrs. Vidaliea develops a sudden onset of hypoxemic respiratory failure and is diagnosed with an acute pulmonary embolus. Which one of the following interventions is the priority?

a. Dalteparin (Fragmin) 5,000 units subcutaneous daily
b. Aspirin 81 mg
c. Coumadin (Warfarin) 10 mg loading dose
d. Heparin IV 80 units/kg bolus

ANSWER D

Rationale for Correct Response:

Treatment priority for acute pulmonary embolism includes reaching a therapeutic anticoagulation level STAT. Of the options provided, only the loading dose of heparin is sufficient to achieve a rapid therapeutic level.

High dose low molecular weight heparin (e.g., Dalteparin) can also be used to treat venothrombosis, however, this dose is too low for therapeutic coverage (this is the venothrombotic prophylactic dose).

This patient may eventually be converted to a course of Coumadin, however, it takes at least 2 days for Coumadin to impact the INR and often longer to become therapeutic. If the patient is stable and rapid reversibility is not a requirement, Coumadin may be started simultaneously with IV heparin or therapeutic low molecular heparin. Heparin should be continued until the Coumadin is in the therapeutic range.

Aspirin is an antiplatelet agent and not an anticoagulant. Anticoagulants prevent the clot from getting larger while the clot begins its natural degradation process. Should she become hemodynamically unstable, tPA may be indicated (to break the clot apart).

Blueprint Competency Being Tested: 3.4f

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: administering pharmacological agents to facilitate ventilation (e.g., analgesics, reversal agents, sedatives, paralytics, puffers/aerosol therapy).

46. Mark is an 18-year-old man admitted with pneumonia and exacerbation of his asthma. He complains of chest tightness and develops increased wheezes. Which one of the following interventions is the priority?

a. Ipratropium bromide (Atrovent)
b. Bethamethasone (QVAR)
c. Salmeterol/fluticasone (Advair)
d. Salbutamol (Ventolin)

ANSWER D

Rationale for Correct Response:

The first line agent (priority) for the treatment of acute asthma or bronchoconstriction is fast acting bronchodilators. Short acting (rapid onset) beta adrenergic agents, usually Salbutamol (Ventolin) is the priority. This is referred to as a rescue inhaler.

Although Atrovent is also a bronchodilator, it is a parasympathetic blocker with a longer onset of action. It can be combined with Salbutamol to provide synergistic bronchodilation (e.g., Combivent) but it's bronchodilating properties are not as powerful.

Advair contains Salmeterol, a long acting B2 agonist. This drug is used to provide long term bronchodilation for maintenance therapy and should be switched to short acting agents during an acute crisis. Repeated doses should not be used for rescue therapy.

Finally, while this patient also needs either systemic (Solumedrol or Prednisone) or inhaled steroids (such as Fluticasone or Bethamethasone), reliever meds are the first priority during acute asthma. Steroids are used to decrease the inflammation and prevent worsening of the asthma symptoms but they take time to work.

Blueprint Competency Being Tested: 3.4j

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: troubleshooting mechanical supports (e.g., ventilator, continuous positive airway pressure [CPAP] and BiLevel masks).

47. Mrs. Greir develops hypercarbia and hypoxemia following extubation. She is started on Bilevel non-invasive ventilation in an effort to avoid reintubation. Which one of the following interventions should be included in her plan of care?

a. Integumentary inspection of nose and face
b. Nasal-tracheal suctioning to facilitate secretion clearance
c. Oral intake of high calorie milk shakes
d. Administration of regular dose benzodiazepines

ANSWER A

Rationale for Correct Response:

Skin breakdown with potential injury to the cartilage of the nose can occur with prolonged use, therefore, careful inspection and mask adjustment to rotate pressure is important. Suctioning should only be performed if secretions are present and the patient is unable to clear them with coughing. Oral intake should be limited during this acute exacerbation due to the potential for aspiration/need for intubation. Benzodiazepines should be used very sparingly or withheld completely in a non-intubated patient with hypercarbia.

Blueprint Competency Being Tested: 3.3c

Recognizes an actual or potential life-threatening alteration of the respiratory system, including: pleural abnormalities (e.g., tension pneumothorax, pleural effusion, hemothorax).

48. Three days after insertion of a chest tube for pleural effusion/empyema, Mr. Butler's ventilator begins to alarm for low exhaled tidal volume. The set tidal volume is 200 cc greater than the exhaled tidal volume. Upon examination, increased bubbling is noted in the underwater seal chamber of the chest drainage unit. Which one of the following problems do these findings suggest?

a. Chest tube obstruction
b. Bronchopleural fistula
c. Asynchrony with ventilator
d. Air trapping

ANSWER B

Rationale for Correct Response:

The increased air leak indicates loss of additional air from the lung. The inhaled tidal volume and exhaled tidal volume should be very similar. When less air is exhaled than inhaled, it suggests another route for air elimination. The increased leak in the underwater seal indicates it is coming from a leak between the airways and the pneumothorax.

Blueprint Competency Being Tested: 1.2

Understands the rationale for and clinical implications of diagnostic results (e.g., computed tomography [CT or CAT scan], magnetic resonance imaging [MRI], electroencephalogram [EEG], transcranial Dopplers [TCD]).

49. Mrs. Karver develops a sudden facial droop with dysphagia. Which diagnostic test is best for showing acute infarction of the brain tissue?

a. MRI
b. EEG
c. CT scan
d. Cerebral angiogram

ANSWER A

Rationale for Correct Response:

MRI is best for identification of an acute infarction. It can take a few days before an acute infarction will be evident on CT (large infarcts may show up earlier). CT is usually the first investigation at the onset of symptoms of stroke and is done to rule out hemorrhagic stroke, which enables rapid definitive treatment (e.g., thrombolytics if hemorrhage is rule out within 4.5 hours of symptom onset). CT can also be performed faster.

Blueprint Competency Being Tested: 4.1b

Interprets data (initial and ongoing assessment or response to interventions) related to the gastrointestinal function, including: laboratory results (e.g., liver profile, glucose, amylase, proteins, electrolytes, albumin).

50. Mr. Fever had an ischemic bowel requiring urgent total colectomy and ileostomy. He is receiving central TPN. One week following admission to ICU, his Alanine Aminotransferase (ALT) and his Aspartate Aminotransferase (AST) double, and his Alkaline Phosphatase (ALP) and direct bilirubin increase 4 fold. His lipase and pancreatic amylase are mildly elevated and his ammonia is normal. These findings are most consistent with which complication?

a. Hepatic ischemia
b. Biliary tract disease
c. Pancreatitis
d. Hemolysis

ANSWER B

Rationale for Correct Response:

AST and ALT are the two liver enzymes that reflect hepatocyte damage. ALT ("A Liver Test") is the most specific to liver damage (many things increase AST).

Alkaline phosphatase is an enzyme that is released from damaged cells near the biliary drainage system. It is also non-specific, as it can come from other areas such as bone.

Bilirubin is a byproduct of red blood cell breakdown. Total bilirubin is the sum of the bilirubin that is still bound to protein (pre liver) and the bilirubin that is conjugated (post liver bilirubin). Pre liver bilirubin (called indirect bilirubin) is bilirubin that is still bound to protein. Protein bound bilirubin is transported to the liver where it undergoes conjugation (made water soluble for elimination in the urine and faeces). Protein bound bilirubin is therefore also referred to as "unconjugated". Hemolysis and resolution of a large hematoma are examples of causes for unconjugated hyperbilirubinemia.

Direct bilirubin or conjugated bilirubin is the water-soluble form of bilirubin, which is the form after the liver has removed the protein. Most labs only measure total bilirubin and direct bilirubin. The indirect or unconjugated bilirubin is inferred by subtracting the total bilirubin – direct bilirubin values.

Bilirubin can increase for many reasons during critical illness, including shock states/organ dysfunction, medication use, liver disease or injury and impaired biliary outflow. When bilirubin is elevated, the AST and ALT (called the transaminases) and alkaline phosphatase values are examined to see if liver function or biliary outflow problems could be the cause.

If the AST and ALT are more significantly elevated than the alkaline phosphatase, liver dysfunction is suggested.

In this case, the alkaline phosphatase is disproportionately higher than the AST or ALT. This is suggestive of a biliary drainage problem. Gallstone cholecystitis would produce this type of pattern.

Acalculous cholecystitis is serious complication of critical illness. It is most common among patients who are NPO (such as those on TPN), have sepsis or organ dysfunction, experience dehydration (which may increase bile viscosity) or when gallbladder contractility and emptying is reduced (e.g., when NPO). Biliary stasis can cause gram negative organisms to accumulate, leading to inflammation and sepsis.

“Liver function” tests are usually done weekly in patients on TPN to monitor for complications such as fatty liver disease and acalculous cholecystitis.

Blueprint Competency Being Tested: 4.2a

Recognizes actual or potential life-threatening alterations to the gastrointestinal system, including: ischemic disorders (e.g., infarcted bowel, hepatic failure, cirrhosis, abdominal compartment syndrome).

51. Mrs. Volaro is admitted with a diagnosis of septic shock of unknown origin. She received aggressive fluid resuscitation, is started on broad spectrum antibiotics, vasopressors and steroids. She is now on significant doses of norepinephrine (levophed) and vasopressin. Despite maintaining a MAP of 65 mmHg, her lactate rises from 4.5 to 8.8 and she develops new onset diarrhea. Which one of the following interventions is a priority?

a. Repeat blood cultures
b. Hepatic ultrasound
c. Abdominal X-ray
d. Insertion of rectal tube

ANSWER C

Rationale for Correct Response:

Rising lactate and new diarrhea suggests an acute abdomen, which could be due to ischemia of the bowel or bowel perforation. An abdominal X-ray should be done first to look for evidence of free air.

A surgical consult with urgent CT abdomen may also be indicated.

Blueprint Competency Being Tested: 3.4f

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: administering pharmacological agents to facilitate ventilation (e.g., analgesics, reversal agents, sedatives, paralytics, puffers/aerosol therapy).

52. Mrs. Farmer is started on neuromuscular blocking agents. Which one of the following interventions is a priority?

a. Titrate sedation using a sedation scoring tool
b. Maintain eyes in a closed position
c. Use of oral hydration solutions
d. Administration of PRN analgesia

ANSWER B

Rationale for Correct Response:

The inability to blink or lubricate the eyes puts the cornea at risk for abrasion. Diligent eye care, including keeping the lids closed to maintain lubrication is essential. Sedation scoring tools are not useful as neuromuscular blockers mask motor activity; level of consciousness and symptoms are masked by the pharmacological paralysis. Patients on NMBs generally have excessive oral secretions, and analgesia should be administered by high dose continuous infusion.

Blueprint Competency Being Tested: 4.4e

Selects the appropriate evidenced-informed nursing interventions to correct alterations in gastrointestinal functions, such as: managing inflammatory disorder (e.g., peritonitis, pancreatitis, hepatitis, hepatic failure).

53. Mr. Aikin is admitted with acute pancreatitis following ERCP. He develops ARDS and requires intubation and mechanical ventilation, with fluid resuscitation for systemic inflammation. Which one of the following interventions would you anticipate?

a. Early initiation of TPN
b. NPO with gastric drainage
c. Enteral feeding
d. Avoidance of narcotics

ANSWER C

Rationale for Correct Response:

Early enteral feeding is recommended by the 2016 American Society of Parenteral and Enteral Nutrition (ASPEN) guidelines for patients with pancreatitis, except in the most extreme necrotizing cases.

TPN is only recommended if attempts at enteral feeding are unsuccessful. While initial feeding attempts in patients with pancreatitis can be made using a gastric feeding tube, patients who are critically ill with high gastric output may require feeding tube advancement into the small bowel. Patients can be fed through a small bowel feeding tube during gastric drainage while providing gastric drainage if required. Elemental (predigested) formulas may also aid in enteral feeding tolerance during pancreatitis if a deficiency of pancreatic enzymes is contributing to feeding intolerance.

Although narcotics can decrease peristalsis and gastric emptying, unresolved pain can increase gastric and pancreatic output, which would worsen symptoms. Pain control with narcotics is an important part of the treatment.

Blueprint Competency Being Tested: 1.1c

Interprets data (initial and ongoing assessment or response to interventions related to the neurologic system), including: intracranial waveforms and pressures (e.g., troubleshooting inaccurate results, interpreting abnormal findings).

54. Mr. Singh is a 68-year-old man who had an intraventricular hemorrhage. He has an external ventricular drain (EVD) that is open to drainage at 10 cmH_20 above the reference level. It has been draining ~20 ml per hour for the past 24 hours. The waveform suddenly becomes dampened with a pressure reading of 13 mmHg on the bedside monitor. There has been no CSF drainage during the past hour. How should these findings be interpreted?

a. Lack of drainage is an expected finding
b. Clotting/obstruction of the catheter should be suspected
c. The hydrocephalus has resolved
d. The drainage chamber should be raised

ANSWER B

Rationale for Correct Response:

The drainage chamber is positioned at 10 cmH_20. If the circuit is open, this means that the catheter should drain automatically whenever the pressure inside the cranial compartment is greater than the level of the drainage chamber (or 10 in this case). A pressure of 10 cmH_20 is equivalent to a pressure of ~7.4 mmHg (on the bedside monitor).

The pressure on the bedside monitor is 13 mmHg, which is well above the level of the drainage collection chamber (10 cmH_20 or 7.4 mmHg). This indicates that drainage would be expected.

While drainage should occur in this situation, drainage will only occur if the catheter is patent AND the ventricle has CSF available to drain. Several signs point to catheter blockage as the possible cause.

In this scenario, the history of ventricular hemorrhage raises the suspicion of catheter obstruction. The drainage stopped abruptly despite a favourable pressure gradient, the

waveform quality is poor and the patient has a history of cerebral bleeding (which is frequently associated with catheter clotting).

A quick troubleshooting step to assess for catheter obstruction is to temporarily lower the drainage chamber to see if drainage can be initiated. If drainage does not begin, notify the physician. The physician will need to determine if this is due to catheter obstruction (which may be treated by catheter irrigation by the physician), or if drainage has stopped due to catheter malposition or increased cerebral edema (with a decrease in ventricular CSF volume). A CT would be required to evaluate catheter malposition or edema.

The pressure of 13 mmHg may be inaccurate, particularly given the poor waveform and if measured through a fluid filled pressure monitoring circuit. Cerebral edema is unlikely if the pressure is actually 13 mmHg.

Blueprint Competency Being Tested: 4.2e

Recognizes actual or potential life-threatening alterations to the gastrointestinal system, including: complications of enteral or parenteral feeding (e.g., sinusitis, diarrhea, aspiration, constipation, hyperglycemia, refeeding syndrome).

55. Christine is a 19-year-old who suffers from anorexia and bulimia. She is admitted with failure to thrive and weights 40 kg. Which one of the following interventions is a priority?

a. Initiate central TPN while encouraging oral intake
b. Initiate tube feeding at a rate that matches daily energy requirements
c. Monitor frequently and replace phosphate, magnesium and potassium
d. Administer Loperamide PRN if diarrhea develops

ANSWER C

Rationale for Correct Response:

Severely malnourished patients are at risk for refeeding syndrome. During starvation, the reduced carbohydrate level causes insulin levels to fall. Low insulin levels will increase glucagon output. Glucagon favours the utilization of protein and fat stores for energy. Decreased intake of dietary electrolytes may be associated with intracellular depletion even when serum concentrations are normal.

Upon initiation of feeding, the rising blood glucose level causes insulin output to resume. Insulin stimulates glycogen, protein and fat synthesis, processes that increase the demand for phosphate, magnesium and potassium. Insulins moves these electrolytes into the already depleted cells, which can cause a critical reduction in serum concentrations. Myocardial irritability with the potential for cardiac arrest is the major risk associated with low serum concentrations.

Feeding should be gradually reintroduced to prevent rapid changes in electrolyte concentrations or GI intolerance. The enteral route is preferred. A patient who is this malnourished may continue to eat orally, but may need supplementation by feeding tube to meet caloric requirements. Electrolytes must be monitored and corrected before starting feeding, and monitored frequently (several times per day) until electrolyte replacement requirements stabilize.

Antidiarrheal agents should not be initiated until infectious causes are ruled out (e.g., negative C-difficile cultures are negative). Antidiarrheals delay removal of toxins and could precipitate perforation of the colon in the setting of C-Diff colitis.

Blueprint Competency Being Tested: 4.3

Implements the appropriate evidence-informed nursing interventions to manage the patient who has ingested a toxic substance (e.g., acetylsalicylic acid, antidepressants, acetaminophen, toxic alcohols).

56. Mr. Kieffer is admitted following an overdose of beta blockers. Which one of the following antidotes would you anticipate?

a. Levothyroxine (Synthroid)
b. Glucagon
c. Norepinephrine (Levophed)
d. N-aceylcysteine (Mucomyst)

ANSWER B

Rationale for Correct Response:

Beta blockade cases a decrease in the production of intracellular cyclic adenosine monophosphate (cAMP). This causes a variety of metabolic and cardiovascular effects including: bradycardia, decreased contractility and blood pressure, and hypoglycemia. Beta blockers with the highest lipid concentration (such as propranolol) have a larger distribution and are better able to penetrate the central nervous system and cause CNS toxicity (including seizure and coma).

Glucagon is an accepted antidote for beta blocker and calcium blocker overdose. Glucagon will increase HR and contractility, independent of beta adrenergic receptors. Consequently, it may work where beta stimulating drugs such as epinephrine or isoproterenol may not.

Administration can also be diagnostic. There is little evidence to support a benefit to charcoal, however, it may still be administered in conjunction with controlled gastric lavage to remove any undigested pills. Catecholamines and atropine may be considered to treat hypotension and bradycardia and benzodiazepines are the drug of choice for seizures. Cardiac pacing and magnesium may also be considered.

Blueprint Competency Being Tested: 4.4a

Selects the appropriate evidenced-informed nursing interventions to correct alterations in gastrointestinal functions, such as: promoting early and safe enteral feeding (e.g., indications, patient positioning to prevent aspiration, tube placement, post pyloric feeding tube).

57. Following insertion of a nasogastric feeding tube, Mrs. Pinkerton is started on continuous enteral feeding infusion at 50 ml/hr. Three hours later, she has a residual volume of 400 ml. Which one of the following interventions would be the priority?

a. Remove the feeding tube and replace with a nasal-jejunal tube
b. Position Mrs. Pinkerton on her left side
c. Initiate Metoclopramide (Maxeran)
d. Administer a dose of Pantoprazole (Pantoloc)

ANSWER C

Rationale for Correct Response:

Although this residual volume represents 4 hours of feeding, this is less than one cup of liquid. This may be insufficient to stimulate effective gastric emptying. The Guidelines for the Provision and Assessment of Nutrition Support Therapy (2016, American Society of Parenteral and Enteral Nutrition [ASPEN], no longer recommends the routine measurement of gastric residual volumes.

Head of bed elevation, right sided positioning and use of a prokinetic agents (such as metoclopramide) should be initiated to facilitate gastric emptying. While the ideal placement for the initial feeding tube may be small bowel, it is more appropriate to initiate these simple strategies before putting the patient through a second tube insertion. If prokinetics and positioning are unsuccessful, the next step should be to consider a small bowel feeding tube and/or rule out any mechanical obstruction or ileus.

Pantoloc decreases gastric acidity; it does not promote feeding.

Blueprint Competency Being Tested: 4.4b

Selects the appropriate evidenced-informed nursing interventions to correct alterations in gastrointestinal functions, such as: optimizing parenteral nutrition (e.g., indications, lipid therapy, glucose concentration, selection of access site).

58. Which one of the following interventions should be included in the care of a patient receiving Central TPN?

a. Change lipid tubing every 72 hours
b. Change central line every 7 days
c. Weekly blood cultures
d. Routine liver function tests

ANSWER D

Rationale for Correct Response:

Patients receiving TPN are at risk of developing fatty liver or cholestatic disease, as well as electrolyte or trace element deficiencies (including essential fatty acids). Liver function, coagulation assessment, lipid profiles and protein and nutritional markers should be monitored routinely. A dietitian consult should be initiated whenever possible to ensure appropriate therapy monitoring.

The Center for Disease Control guidelines for the prevention of intravascular infections recommends changing IV tubing with 96 hours for standard infusions, but recommends more frequent changes for lipids and blood tubing. Blood cultures are only indicated if there is a clinical indication (e.g., fever, elevated white count).

Blueprint Competency Being Tested: 4.4c

Selects the appropriate evidenced-informed nursing interventions to correct alterations in gastrointestinal functions, such as: administering pharmacological agents (e.g., motility enhancers, GI prophylaxis).

59. Mrs. Clan develops a leak of gastric contents around her new gastrostomy tube site. Feeds are discontinued and she is started on a medication to decrease gastroenteropancreatic secretions Which medication might be ordered to produce this effect?

a. Pantoprozole (Pantoloc)
b. Octreotide (Sandostatin)
c. Metoclopramide (Maxeran)
d. Vasopressin

ANSWER B

Rationale for Correct Response:

Octreotide inhibits pathologically increased secretion of peptides and serotonin produced within the gastroentero-pancreatic (GEP) endocrine system, and growth hormone. It can be used in pancreatitis or post pancreatic surgery to reduce secretions and prevent complications such as pancreatic fistula or abscess, or to reduce secretions in other gastric leak syndromes. It is also believed to reduce splanchnic blood flow primarily by inhibiting vasoactive gastrointestinal hormone secretion and by exerting a direct vasomotor effect on splanchnic vessels, thus reducing portal blood flow. It can also be used in the emergency management of bleeding gastroesophageal varices in patients with cirrhosis.

Blueprint Competency Being Tested: 4.4g

Managing hemorrhagic disorders (e.g., upper and lower gastrointestinal bleeding, splenic injuries, hepatic injuries, esophageal varices).

60. Mr. Butler is admitted with bleeding from esophageal varices. He is intubated and ventilated for airway protection. A Minnesota Tube is inserted to tamponade his varices. Which of the following should be included in the care of a patient with a Minnesota tube?

a. The esophageal balloon must be inflated if the gastric balloon is deflated
b. The esophageal balloon should be inflated at all times
c. Traction is maintained through the use of weights on an overbed pully
d. Airway is most likely to occur if the gastric balloon is inflated

ANSWER C

Rationale for Correct Response:

Although rarely used (bleeding can usually be controlled through interventional radiological or endoscopic treatment), balloon tamponade may be required for uncontrolled bleeding from esophageal varices. The Minnesota tube is more common (for this uncommon procedure) than the Sengstaken-Blakemore tube. The Minnesota tube has 4 lumens (esophageal and gastric balloon and esophageal and gastric suction). The Sengstaken-Blakemore has 3 lumens (it does not have esophageal suction).

Ideally, inflation of the gastric balloon should be done while measuring balloon pressure with a manometer. A baseline measurement should be taken prior to balloon inflation. Initially the balloon should be inflated with 100 cc of air, while listening for the sounds of gastric insufflation with a stethoscope. The balloon pressure should be rechecked after each additional 100 cc of air is added, to a maximum of 450 cc. The gastric balloon pressure should not exceed a 15 mmHg rise from baseline. The balloon is then "snugged" into position by the application of traction. The gastric balloon can be inflated alone, or with an inflated esophageal balloon.

Traction is applied to the varices using the weight of a 500 ml IV bag. A rope is tied to the end of the Minnesota tube and pulled upward through a pully to an overbed frame. The 500 ml IV bag hangs from the rope to apply traction. Traction should only be applied if the gastric balloon is inflated to prevent upward migration of the balloon (risk for airway obstruction).

If bleeding cannot be controlled by the gastric balloon alone, the esophageal balloon may need to be inflated to provide additional compression of the bleeding varices. The esophageal balloon should be inflated to a maximum pressure of 25-40 mmHg.

Ideally, the physician should deflate the esophageal balloon every 2 hours for 10 minutes, to prevent esophageal necrosis. The balloon should never be left inflated for > 12 hours. One of the most serious complications is the upward migration of the Minnesota tube into the airway. This is most likely to occur if the gastric balloon is over inflated, or the esophageal balloon is inflated while the gastric balloon is deflated.

The mouth should be inspected every hour, and the tube repositioned from side to side to prevent oral mucosal damage. A pair of scissors should be kept at the bedside at all times. All lumens of the tube can be cut to cause immediate tube deflation in the event of accidental airway obstruction from migration of the tube.

Blueprint Competency Being Tested: 4.4f

Selects the appropriate evidenced-informed nursing interventions to correct alterations in gastrointestinal functions, such as: managing inflammatory disorder (e.g., peritonitis, pancreatitis, hepatitis, hepatic failure).

61. Mr. Gordinski is admitted with a diagnosis of hepatic encephalopathy secondary to cirrhosis. His ammonia level dropped to normal in the first 24 hours and he had one bowel movement since admission. He remains in coma. Which one of the following interventions is a priority?

a. Lactulose
b. N-acetylcysteine (Mucomyst)
c. Sodium Polystyrene (Kayexalate)
d. Glutamine supplements

ANSWER A

Rationale for Correct Response:

Ammonia is produced by the bacterial degradation of the byproducts of protein metabolism. Hepatocytes convert ammonia to urea, making it water soluble for elimination in the urine. In liver failure, the loss of functioning hepatocytes reduces the ability to detoxify ammonia. If portal venous to systemic shunting occurs, ammonia may also be diverted away from the liver and into the systemic circulation without detoxification. Ammonia has a number of neurotoxicities.

Although some controversy exists regarding the role of ammonia in the development of encephalopathy (some patients have encephalopathy with normal ammonia levels, whereas, others have high ammonia levels without encephalopathy), lactulose administration is recommended for the treatment of hepatic encephalopathy as it appears to decrease ammonia in a number of ways. Lactulose inhibits the production of intestinal ammonia and aids in the elimination of ammonia producing bacteria. Lactulose should be given regardless of the ammonia level, until the patient is awake. Bowel movements that are not facilitated by lactulose administration may not have the same benefit. More than one bowel movement per day is desired.

Blueprint Competency Being Tested: 5.1b

Interprets data (initial and ongoing assessment or response to interventions) related to the renal system, including: laboratory results (e.g., electrolytes, urine electrolytes, urea, creatinine, urinalysis, serum and urine osmolality, anion gap, drug levels).

62. Ms. Sibley is in a positive fluid balance with urine output < 30 ml/hr. She has significant peripheral edema. Labs are as follows:

Na 148
K 4.9
Cl 105
HCO_3 23
Urea 16 mmol/L
Creatinine 85 umol/L
Urine sodium is low, and serum and urine osmolality are both elevated.

Which one of the following interventions would you anticipate?

a. Furosemide (Lasix)
b. 0.45% normal saline
c. 0.9 % normal saline or Ringer's Lactate
d. Fluid restriction

ANSWER C

Rationale for Correct Response:

The increased sodium, potassium and urea (with normal creatinine), concentrated blood and urine (increased serum and urine osmolality) and low urine sodium (sodium is reabsorbed from the urine in dehydration, reducing the amount or sodium in the urine) indicates that the patient is intravascularily dry. Rehydration should always be with isotonic crystalloid (such as 0.9% normal saline or Ringer's Lactate) or colloid solutions.

Blueprint Competency Being Tested: 5.6

Selects appropriate evidence-informed nursing interventions to optimize renal function, such as: optimizing cardiac output (e.g., fluid management, inotropic agents).

63. Mr. Bright, 75 yrs old, has a history of Type II diabetes and chronic kidney disease. He is scheduled for a CT abdomen with contrast. Which one of the following interventions should be anticipated?

a. Furosemide (Lasix)
b. Fluid
c. Mannitol
d. Low dose Dopamine (Intropin)

ANSWER B

Rationale for Correct Response:

The evidence for renal protection is limited. The strongest evidence for preventing contrast induced nephropathy is to ensure adequate intravascular volume prior to administration of contrast. The administration of normal saline with sodium bicarbonate may also be considered.

Blueprint Competency Being Tested: 5.4

Recognizes potential life-threatening alterations in renal function (e.g., acute kidney injury criteria).

64. Mr. Wilson undergoes an open repair of an abdominal aortic aneurysm. In the first 24 hours following surgery, his creatinine doubles and his urine output decreases to < 10 ml/hr. Which one of the following is the most likely cause of his acute kidney injury?

a. Postrenal
b. Intrarenal
c. Prerenal
d. Aneurysmal

ANSWER C

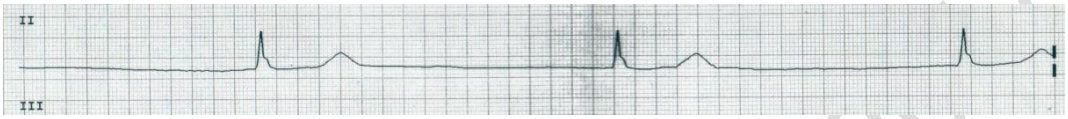
Rationale for Correct Response:

Renal failure due to a decrease in blood flow to the kidney is referred to as prerenal cause for renal insufficiency. Following aneurysm repair, aortic cross clamping, hypovolemia/hypotension, renal artery involvement, atherosclerotic disease of the renal blood vessel and/or renal thrombosis are all possible causes for reduced renal blood flow. Prerenal is the most likely cause for the kidney injury.

Blueprint Competency Being Tested: 5.6b

Selects appropriate evidence-informed nursing interventions to optimize renal function, such as: optimizing cardiac output (e.g., fluid management, inotropic agents).

65. Ms. Lo is admitted with oliguric renal failure. She suddenly develops hypotension with the following rhythm:



Which one of the following interventions should be anticipated?

a. Potassium bolus
b. Magnesium Sulphate
c. Insulin and dextrose
d. Amiodarone (Cordarone)

ANSWER C

Rationale for Correct Response:

This rhythm, in the setting of oliguric renal failure is typical of hyperkalemia. The treatment is insulin with glucose, sodium bicarbonate and calcium gluconate.

Blueprint Competency Being Tested: 5.6a

Selects appropriate evidence-informed nursing interventions to optimize renal function, such as: optimizing cardiac output (e.g., fluid management, inotropic agents).

66. Mr. Yokobi is admitted with cardiogenic shock and oliguric acute kidney injury. Hemodynamics reveal the following: BP 105/60 (~70) Sinus rhythm (108) CI 1.8 (CO 2.4) CVP 23 PWP 25 SVRI 2088 (SVR 1566). Which one of the following interventions would you anticipate?

a. Low dose Dopamine (Intropin)
b. Captopril (Capoten)
c. Metoprolol (Betaloc)
d. Dobutamine (Dobutrex)

ANSWER D

Rationale for Correct Response:

The acute kidney injury is most likely prerenal, due to the low cardiac output. Cardiac output is improved by optimizing heart rate and rhythm, preload, contractility and afterload. While beta blockers and ACE inhibitors are important interventions following myocardial infarction, their care contraindications to starting these drugs at this time (beta blocker is contraindicated in cardiogenic shock and renal failure is a contraindication to ACE inhibitor).

The heart rate may come down by increasing the stroke volume. Since the intravascular volume is high and the MAP is adequate, a drug with inotropic and vasodilator properties might be ideal (such as Dobutamine or Milrinone). The drugs should be initiated cautiously to avoid hypotension. Dobutamine may cause tachycardia in some individuals. Milrinone dosing is reduced in renal failure.

Low dose Dopamine is a dopaminergic dose. Although it is proposed to increase renal blood flow at this dose, there is a lack of research evidence to substantiate any beneficial effect. This dose is too low to provide inotropic benefit and may worsen the tachycardia (tachycardia is associated with worse outcomes after MI).

Blueprint Competency Being Tested: 5.5c

Understands the rationale for and clinical implications of renal replacement therapy.

67. Mrs. Clementine is on Continuous Renal Replacement Therapy and is receiving hemodiafiltration. Which one of the following interventions would increase clearance?

a. Increased fluid removal
b. Use of citrate anticoagulation
c. Use of a larger filter
d. Reduction in the blood flow rate

ANSWER C

Rationale for Correct Response:

Clearance (removal of waste solutes) is increased by the use of a larger filter or higher flow rates of dialysate, blood flow or hemofiltration fluids. Post dilution hemofiltration provides better clearance than an equal volume of pre-dilution hemofiltration. Increasing the fluid removal rate will increase water loss (ultrafiltration); it will not impact clearance. Citrate is a method for filter anticoagulation that is independent of clearance.

Blueprint Competency Being Tested: 6.1

Interprets data (initial and ongoing assessment or response to interventions) related to the endocrine system, including laboratory tests (e.g., blood glucose, arterial blood gases [ABGs], thyroid-stimulating hormone [TSH], T4, T3, cortisol, osmolality, electrolytes, urine ketones).

68. Ms. Eaves has a TSH that is 39 (normal 0.2-4.2 mIU/L). T4 and T3 are both very low. Which one of the following problems does this indicate?

a. Hyperthyroidism
b. Hypothyroidism
c. Sick euthyroid of critical illness
d. Pituitary dysfunction

ANSWER B

Rationale for Correct Response:

Thyroid Stimulating Hormone (TSH) is released from the pituitary, and stimulates the thyroid gland to produce T4 and T3 (in the presence of sufficient iodine). Most of the thyroid hormone produced is thyroxine (T4). T4 is converted to T3 in the thyroid and in most cells of the body. It is the biologically active form of the hormone.

In primary hypothyroidism, the thyroid gland is unable to produce T4 and T3. The low T4 and T3 levels stimulate the hypothalamus release more Thyroid Releasing Hormone (TRH). TRH in turn, stimulates the release of Thyroid Stimulating Hormone (TSH) from the anterior pituitary. TSH stimulates the thyroid to absorb more iodine and to make T4 and T3. Because the thyroid gland is not working well, the T4 and T3 levels remain low and the TSH continues to rise in an attempt to stimulate T4 and T3 production.

This patient has primary hypothyroidism (the low T4 and T3 is due to failure of the thyroid gland). Secondary and tertiary hypothyroidism occurs when the pituitary (low TSH) or hypothalamus (low TRH) fail respectively.

During critical illness, patients often display a variety of thyroid abnormalities. Most frequently, they have a mild elevation in their TSH, and mild reduction in their T4 and T3. This is referred to as sick euthyroid (normal thyroid function during sickness). The TSH may be elevated, but rarely > 15. Thyroid function usually returns to normal following recovery from critical illness. On occasion, patients with mild thyroid hormone dysfunction go on to develop true hypothyroidism. There is controversy regarding the management of sick euthyroid, however, treatment is not usually recommended.

Blueprint Competency Being Tested: 6.3a

Selects appropriate evidenced-informed nursing interventions to correct alterations in endocrine function, such as: managing antidiuretic hormone (e.g., diabetes insipidus [DI], syndrome of inappropriate antidiuretic hormone [SIADH]).

69. Following a severe traumatic brain injury, Jamie's urine output increases to 300 ml/hr, BP decreases to 90/60 and HR increases to 144. His serum sodium is 155 mmol/L. Which one of the following interventions is the priority?

a. Obtain urine and serum osmolalities
b. Change IV fluid to 0.45 % normal saline
c. Administer desmopressin (DDAVP)
d. Initiate Norepinephrine (Levophed) infusion

ANSWER A

Rationale for Correct Response:

In the setting of acute traumatic brain injury, these findings could indicate Diabetes Insipidus. Inadequate output of antidiuretic hormone from the hypothalamus-posterior pituitary is known as central Diabetes Insipidus. The treatment for this hormone deficiency is the administration of antidiuretic hormone in the form of desmopressin (DDAVP) or vasopressin, and the replacement of fluid and electrolyte losses.

The diagnosis must be confirmed first. These findings may also be present in the recovery phase (high output) of acute kidney injury. Serum and urine osmolities will confirm the diagnosis. In Diabetes Insipidus, serum sodium and serum osmolality are high (hemoconcentration due to inappropriate volume loss), and urine osmolality is low (inappropriate loss of large volumes of dilute urine).

Treatment of the hypovolemia with fluid (not vasopressors) is the priority, regardless of the underlying cause. Initial resuscitation during hypotension should always include isotonic solutions, even though conversion to lower sodium concentrations will be the goal if this is Diabetes Insipidus.

Blueprint Competency Being Tested: 6.2b

Recognizes actual or potential life-threatening alterations in endocrine function, such as: antidiuretic hormone (e.g., diabetes insipidus [DI], syndrome of inappropriate antidiuretic hormone [SIADH]); hyperglycemia (e.g., ketoacidosis [DKA], hyperglycemic hyperosmolar non-ketotic syndrome [HHNS]).

70. Mr. Veldman is admitted with decreased level of consciousness. His admission labs are:

Blood glucose 56 mmol/L
Na 143
K 4.8
Cl 109
HCO_3 22
PaO_2 72
PCO_2 45
pH 7.36
HCO_3 21.

Which one of the problems is indicated by these findings?

a. Diabetic ketoacidosis
b. Glucagon overdose
c. Non-ketotic hyperosmolar coma
d. Adrenal crisis

ANSWER C

Rationale for Correct Response:

This patient has hyperglycemia in the absence of a metabolic acidosis. The anion gap is nearly normal (AG =12*: Normal is less than 12). This is consistent with a non-ketotic hyperosmolar crisis, which is a disorder of Type 2 Diabetes Mellitus.

Insulin prevents the breakdown of fats to ketones. Because Type 2 Diabetic Mellitus patients do have insulin present (they have resistance to insulin), they do not usually develop significant ketosis (although they can have mild ketosis in severe crisis).

It is important to note that in severe hyperglycemic crisis, dehydration can lead to hemoconcentration, hypernatremia and lactic acidosis due to hypoperfusion. If present, lactic acidosis will also widen the anion gap. Thus, an anion gap metabolic acidosis may be present with a non-ketotic hyperosmolar crisis of Type II diabetes. In Type I crisis, the anion gap acidosis may be severe as a result of the combined ketosis and lactic acidosis.

*Anion gap = Na – (Cl + HCO_3). DKA is associated with a metabolic acidosis and very wide anion gap due to the presence of ketones.

Blueprint Competency Being Tested: 6.2c

Recognizes actual or potential life-threatening alterations in endocrine function, such as: adrenal insufficiency (e.g., primary, secondary, associated with critical illness).

71. Martha is admitted following a motor vehicle collision. Her past medical history includes daily Prednisone for the treatment of systemic lupus. Despite fluid replacement therapy and initiation of Norepinephrine (Levophed), her blood pressure remains low. Which one of the following interventions is the priority?

a. Prednisone
b. Epinephrine (Adrenalin)
c. Hydrocortisone (Solucortef)
d. Vasopressin

ANSWER C

Rationale for Correct Response:

Chronic steroid use can cause adrenal suppression. During illness, trauma or other stressors, our body normally increases the output of our stress hormone cortisol. A stressor (such as a trauma) can induce sudden adrenal insufficiency in an individual who is on long term steroid therapy.

Cortisol is our stress hormone. It makes blood vessel responsive to catecholamines, both endogenous and exogenous, and helps to keep our circulating catecholamines from degrading as quickly. The failure to respond to Norepinephrine (Levophed) is consistent with adrenal insufficiency.

All patients on long term steroids who undergo surgery, develop infection or undergo a significant injury need a “stress dose” of steroids. Hydrocortisone is the steroid of choice for stress dosing, as it contains both glucocorticosteroids and minerocorticosteroids and has the fastest onset of action.

Blueprint Competency Being Tested: 6.1

Interprets data (initial and ongoing assessment or response to interventions) related to the endocrine system, including laboratory tests (e.g., blood glucose, arterial blood gases [ABGs], thyroid-stimulating hormone [TSH], T4, T3, cortisol, osmolality, electrolytes, urine ketones).

72. Ms. Oliviera is admitted with coma. She has a BP of 158/75 HR 52 (sinus) and requires intubation for level of consciousness and pulmonary edema. Her temperature is 34 (oral). Which of the following lab tests is the priority?

a. TSH, T3, T4
b. Serum and urine osmolalities
c. Cosyntropinin stimulation test
d. Serum renin and angiotensin levels

ANSWER A

Rationale for Correct Response:

Mild hypertension, bradycardia, respiratory depression, coma and hypothermia are all consistent with hypothyroidism. It should be noted that oral thermometers may have a lower limit of 34 degrees; a temperature reading that is at or near the lowest possible reading should be verified with a low reading probe. Hypothyroidism that leads to coma is called myxedema coma. It is almost always precipitated by a stressor such as sepsis. Investigation for the underlying trigger should go hand-in-hand with the management of hypothyroidism.

Blueprint Competency Being Tested: 6.3

Selects appropriate evidenced-informed nursing interventions to correct alterations in endocrine function.

73. Which one of the following pharmacological agents should be administered with Levothyroxine (Synthroid) for the treatment of acute myxedema coma?

a. Insulin
b. Glucagon
c. Epinephrine (Adrenalin)
d. Steroids

ANSWER D

Rationale for Correct Response:

In the setting of coma due to hypothyroidism, steroids are administered to cover the possibility of simultaneous adrenal insufficiency (a condition known as Schmidt's). This is an autoimmune condition that causes both thyroid and adrenal gland failure.

Blueprint Competency Being Tested: 8.1b

Interprets data (initial and ongoing assessment or response to interventions) related to the musculoskeletal and integumentary systems, including: laboratory results (e.g., creatine kinase [CK], arterial blood gases [ABGs], electrolytes, CBC, myoglobin).

74. Mrs. Kang has been on steroids for the past 6 years to treat severe rheumatoid arthritis. Which one of the following problems would you anticipate?

a. Hypercalcemia
b. Hyperkalemia
c. Hyperlipidemia
d. Hypoglycemia

ANSWER C

Rationale for Correct Response:

Prolonged steroid use causes Cushing Syndrome. Cortisol is a catabolic hormone that favours the breakdown of fuel sources to create energy. Prolonged therapy with glucocorticosteroids causes hyperlipidemia (with atherosclerotic consequences, hypertension and coronary artery disease), protein breakdown (thin fragile skin, muscle wasting particularly in legs and arms), hyperglycemia (DM2), hypocalcemia, sodium and water retention with increased potassium loss in the urine (hypokalemia), fat distribution in back, shoulder and trunk, menstrual irregularities and mood/sleep disorders. Increased risk for infection is also an important problem.

Blueprint Competency Being Tested: 6.3c

Selects appropriate evidenced-informed nursing interventions to correct alterations in endocrine function.

75. Ms. Romansky suddenly develops a decrease in her level of consciousness, even though she has not received any additional sedatives or analgesics. She is on broad spectrum antibiotics, Norepinephrine (Levophed), Vasopressin, steroids and an insulin infusion. She is being fed via a nasal gastric feeding tube. She develops gastric distention with residual volumes equal to 6 hours feeding volume. Which one of the following interventions is the priority?

a. Change feeding tube to small bowel placement
b. Obtain a STAT blood glucose measurement
c. Initiate a prokinetic agent
d. Arrange for CT Head

ANSWER B

Rationale for Correct Response:

The priority for any patient who has a sudden decrease in level of consciousness (especially when receiving continuous insulin therapy) should be to rule out hypoglycemia. She is on insulin and has not been absorbing her feeds. Failure to absorb feeds should prompt a STAT blood glucose assessment.

Blueprint Competency Being Tested: 7.2

Recognizes potential risk for infection (e.g., immunosuppression, invasive vascular devices, indwelling drainage devices, malnutrition, intubation, hyperglycemia, skin breakdown, nosocomial infections).

76. Which one of the following factors increases the risk for central line infection?

a. Subclavian venous access
b. Chlorhexidine skin prep
c. Tunneled catheters
d. TPN

ANSWER D

Rationale for Correct Response:

The high glucose level and use of lipids in TPN can support bacterial or fungal growth. The Center for Disease Control Guidelines for the Prevention of Intravascular Catheter-Related Infections identifies subclavian access, chlorhexidine skin prep and use of tunneled catheters as preferred strategies.

Blueprint Competency Being Tested: 7.3

Recognizes inflammation and infection (e.g., sepsis syndrome, systemic inflammatory response ***system [SIRS]).***

77. Mr. Vanderveen is admitted with alcoholic pancreatitis. He has a Tº 38.2 WBC 14x 10^9/L (with left shift and increased neutrophils). Following the administration of 3 liters of normal saline, his BP increases to 117/80 from 70/50, HR decreases from 144 to 92 and urine output increases from 10 to 60 ml/hr. He requires intubation for worsening hypoxemia. Which one of the following best explains these findings?

a. Sepsis
b. Severe sepsis
c. Septic shock
d. Systemic Inflammatory Response Syndrome

ANSWER D

Rationale for Correct Response:

Severe pancreatitis causes systemic inflammation. Systemic Inflammatory Response Syndrome (SIRS) is characterized by increased vascular permeability, vasodilation, hypovolemia and hypotension. Pulmonary edema can also develop from increased pulmonary vascular permeability causes pulmonary shunting and Acute Lung Injury or ARDS. Organ dysfunction can develop as a result of intravascular volume deficit and distributive shock. SIRS is defined by the presence of 2 or more of the following findings:

- Tachycardia
- Tachypnea or respiratory alkalosis
- High or low temperature
- High or low white count (with bands >10% or a “left shift”)

Although infection can be a cause for SIRS, tissue injury from leaking pancreatic enzymes can cause a severe SIRS response that is not related to infection.

Sepsis may also develop in severe pancreatitis, if the pancreas becomes infected or the patient develops a secondary infection such as pneumonia. Fever and WBC will usually be much higher when pancreatitis and infection occur simultaneously.

Blueprint Competency Being Tested: 7.7

Selects appropriate evidenced-informed nursing interventions to prevent or correct alterations in the hematologic system including: venous thrombotic disorders: deep vein thrombosis (DVT), pulmonary thromboembolism, vascular access associated thrombosis.

78. Ms. Dorosz, 80 kg, drops her platelet count by >50% 10 days after starting subcutaneous heparin. She develops a swollen right calf and positive Homan's sign. Which one of the following interventions would you anticipate?

a. Change anticoagulant to Dalteparin 15,000 units SC daily
b. Administer Protamine sulphate and discontinue Heparin
c. Stop Heparin and initiate anticoagulation with Fondaparinux (Arixtra)
d. Stop all anticoagulation and initiate pneumatic compression stockings

ANSWER C

Rationale for Correct Response:

These findings are suspicious for the diagnosis of Heparin Induced Thrombocytopenia (HIT). One of the most serious complications associated with HIT is venous and/or arterial thrombosis, and this patient has signs and symptoms of a new DVT despite receiving heparin prophylaxis. The other hallmark of HIT syndrome is a precipitous drop in platelet count by 50%, usually ~10 days after the first exposure to heparin.

Once suspected, all heparin should be stopped, INCLUDING low molecular weight heparins (e.g., Dalteparin). A HIT screen should be drawn to make the diagnosis. Anticoagulation with a non-heparin should be considered, particularly given the finding of venous thrombosis. Fondaparinux is an example of an anticoagulant that can be used in the setting of HIT.

Other anticoagulants that may be used when HIT is present include: Hirudin (Lepirudin), Argatroban or Danaparoid. Pneumatic compression stockings would be contraindicated if DVT is suspected. Heparin should be stopped but protamine sulphate (reversal agent) is not indicated and could lead to more thrombosis.

Blueprint Competency Being Tested: 2.5a

Selects appropriate evidenced-informed nursing interventions to correct alterations in cardiovascular perfusion, such as: administering vasopressors.

79. Mr. Blewett is admitted with hypoxemic and hypercarbic respiratory arrest requiring intubation and ventilation. He has a right lower lobe consolidation on chest X-ray, with copious purulent secretions. WBC is 24×10^9/L and he has a fever. BP 88/55 HR 136 and CVP 18 after 4 L of Ringer's Lactate. Urine output is 10 ml/hr. Which one of the following interventions is a priority?

a. Norepinephrine (Levophed)
b. Dopamine (Intropin)
c. Dobutamine (Dobutrex)
d. Labetolol (Trandate)

ANSWER A

Rationale for Correct Response:

These findings are consistent with septic shock (hypotension despite adequate intravascular volume) due to pneumonia. The best agent would be Norepinephrine, as it produces vasoconstriction with less chance of worsening the tachycardia. The HR is too fast for Dopamine, and Dobutamine might make the BP drop due to vasodilation (may also worsen tachycardia). Labetolol is a vasodilator used for the treatment of hypertension.

Blueprint Competency Being Tested: 9.1a

Interprets data (initial and ongoing assessment or response to interventions) related to each patient's and/or family's psychosocial needs, including: experience of the health crisis (e.g., coping skills, hopelessness, powerlessness, grief, loss, culture, spirituality).

80. Ms. Tam is recovering from a prolonged critical illness. She is having tracheostomy-mask trials each day. She is withdrawn and sad, and tells the nurse she no longer has any control of her life. Which one of the following interventions would best meet her needs?

a. Initiate antidepressant therapy
b. Administer sedation at bedtime
c. Develop a collaborative plan of care
d. Refer Mrs. Tam to a psychiatrist

ANSWER C

Rationale for Correct Response:

All of these interventions may help improve her overall sense of wellbeing, however, her expressed concern is her loss of control. Developing a plan of care collaboratively with Ms. Tam is the best option for responding to this assessment finding**.**

Blueprint Competency Being Tested: 9.2a

Selects appropriate evidenced-informed nursing interventions to facilitate optimal communication, such as: providing opportunities for patient- and family-centred decision-making (e.g., end-of-life decisions, advance directives, transplantation, plan of care).

81. Mr. Ferriere has been on home ventilation for several years with severe COPD. He was admitted for exacerbation of COPD due to pneumonia. At home, he varies his support between Pressure Control ventilation and spontaneous breathing. His pneumonia has now resolved and the plan is to return him to his baseline ventilation. He calls you to his bedside and asks you what his ventilator is set to because he feels short of breath. You tell him he is on Pressure Support, and he becomes very angry. He tells you that he told the respiratory therapist that he has tried Pressure Support in the past and he does not like it. When you speak to the respiratory therapist, she had placed the patient on PS to see if he noticed the difference. Which one of the following is an appropriate response?

a. Encourage Mr. Ferriere to stay on the Pressure Support and give it a chance to work
b. Have the respiratory therapists speak to Mr. Ferriere to explain her interventions
c. Facilitate a meeting between you, the respiratory therapist and Mr. Ferriere to develop a collaborative plan of care
d. Tell Mr. Ferriere that his lungs have changed and the previous mode might not work the same way

ANSWER C

Rationale for Correct Response:

The patient knows his breathing better than anyone else and is experienced with his own ventilation requirements. The goal is to return him to his usual care, not try to wean him from the ventilator. The patient's previous experience and wishes for care should be respected.

Changing the ventilator settings in a less than up front manner and against the patient's expressed wishes is not appropriate and will impact the patient's ability to trust the team. This patient needs to be included in his decision-making and care planning regarding this weaning, and the nurses should facilitate a meeting and advocate on the patient's behalf as required.

Blueprint Competency Being Tested: 9.2b

Selects appropriate evidenced-informed nursing interventions to facilitate optimal communication, such as: providing alternative methods of communication (e.g., use of Passy-Muir valve, communication board, cuff deflation, written communication, interpreter).

82. When using an in-line speaking valve (e.g. Passy-Muir Valve) with a tracheostomy tube, which one of the following interventions is appropriate?

a. Ensure the cuff is always inflated
b. Monitor for adequacy of exhalation
c. Introduce the speaking valve as soon as the tracheostomy is performed
d. Suction PRN by passing the catheter through the centre of the speaking valve

ANSWER B

Rationale for Correct Response:

The cuff must always be deflated when a speaking valve is in place. A speaking valve provides a one-way valve that is open during inspiration and closed during exhalation. The patient can only exhale around the tube. This forces air through the vocal cords to enable speech. It may also facilitate easier swallowing during eating.

There must be enough room between the trachea and the outer diameter of the tube to allow air flow during exhalation. Too large a tracheostomy tube, airway edema (such as immediately after tube insertion or tube exchange) or tracheal stenosis could limit exhaled air flow and volume, therefore the adequacy of exhalation must be assessed. Patients requiring high levels of support may also be unable to tolerate the loss of volume during cuff deflation. Suction catheters cannot be passed through a speaking valve.

Blueprint Competency Being Tested: 2.6d

Selects appropriate evidence-informed nursing interventions to correct alterations in cardiac output, such as: optimizing heart rate or rhythm (e.g., fluid management, pharmacological agents, electrolytes).

83. Following an inferior wall infarction, Mrs. Kempster develops a sinus rhythm with Type I second degree A-V block (Wenkebach) phenomena. She develops episodes of symptomatic bradycardia. Which one of the following interventions would be the priority?

a. Epinephrine (Adrenalin)
b. Cardioversion
c. Atropine
d. Dopamine (Intropin)

ANSWER C

Rationale for Correct Response:

Inferior wall infarction is most frequently the result of right coronary artery disease. Wenkebach is a pattern of blocking characterized by progressive prolongation of the PR interval until a beat is blocked. This is a form of an intermittent block within the AV node (a Type I block).

AV nodal disease or ischemia reinforces the probability of right coronary artery disease. AV nodal ischemia following right coronary artery infarction is typically transient. The need for intervention is usually temporary. Atropine is an effective SA and AV node stimulant. If the patient is symptomatic from the slow HR, atropine may raise the HR effectively without adding unnecessary inotropic or vasoconstricting properties (that increase oxygen demand).

While more potent agents or pacing may become necessary, atropine should be the first line agent for symptomatic bradycardia associated with SA or AV node dysfunction.

Blueprint Competency Being Tested: 9.5

Selects appropriate evidence-informed nursing interventions to promote comfort, such as: non-pharmacological methods of managing discomfort (e.g., alternative therapies, spiritual care, promoting sleep).

84. Mrs. Gupta has advanced cancer. She has been extubated for two days, with orders for no reintubation. She develops increasing dyspnea. Which one of the following agents would best manage these symptoms?

a. Propofol (Diprovan)
b. Narcotics
c. Benzodiazepines
d. Pregabalin (Lyrica)

ANSWER B

Rationale for Correct Response:

Narcotics are the first line agent for the treatment of dyspnea. Pregabalin is for neurogenic pain.

Blueprint Competency Being Tested: 2.1g

Interprets data (initial and ongoing assessment or response to interventions) related to the cardiovascular system, including: pulmonary artery catheter pressures and waveforms (e.g., right ventricular pressure [RVP], pulmonary artery pressure [PAP]).

85. You attempt to perform a pulmonary wedge pressure measurement however, the catheter will not wedge. You identify the following waveform. Which one of the following interventions is appropriate?

a. Alert physician and withdraw catheter until a right atrial tracing appears
b. Draw gases to assess location
c. Avoid further balloon inflation
d. Obtain a chest X-ray

ANSWER A

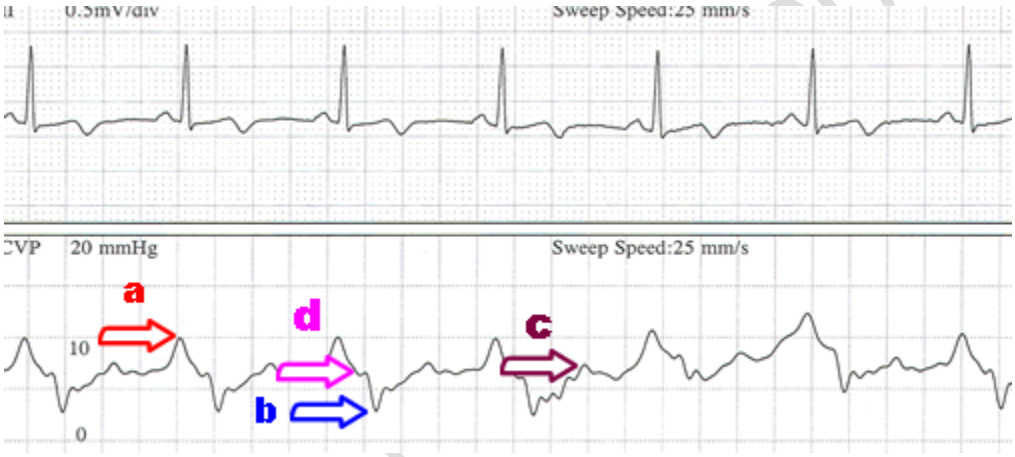
Rationale for Correct Response:

The catheter tip is displaying a right ventricle waveform. The catheter requires withdrawal to the right atrium to avoid ventricular ectopy. The balloon could be temporarily inflated to reduce the chance for ventricular ectopy if withdrawal of the catheter must be performed by the physician. If the tip of the catheter is in the right ventricle, there is no risk that balloon inflation will lead to ischemia.

Blueprint Competency Being Tested: 2.1h

Interprets data (initial and ongoing assessment or response to interventions) related to the cardiovascular system, including: atrial pressures and waveforms (e.g., right atrial pressure [RAP], pulmonary artery wedge pressure [PAWP]).

86. Identify the ideal location for measuring right atrial pressure from the following right atrial waveform.



ANSWER D

Rationale for Correct Response:

The end of diastole can be located just before the "C" wave, also referred to as the "pre C wave" point. It is identified in pink (d).

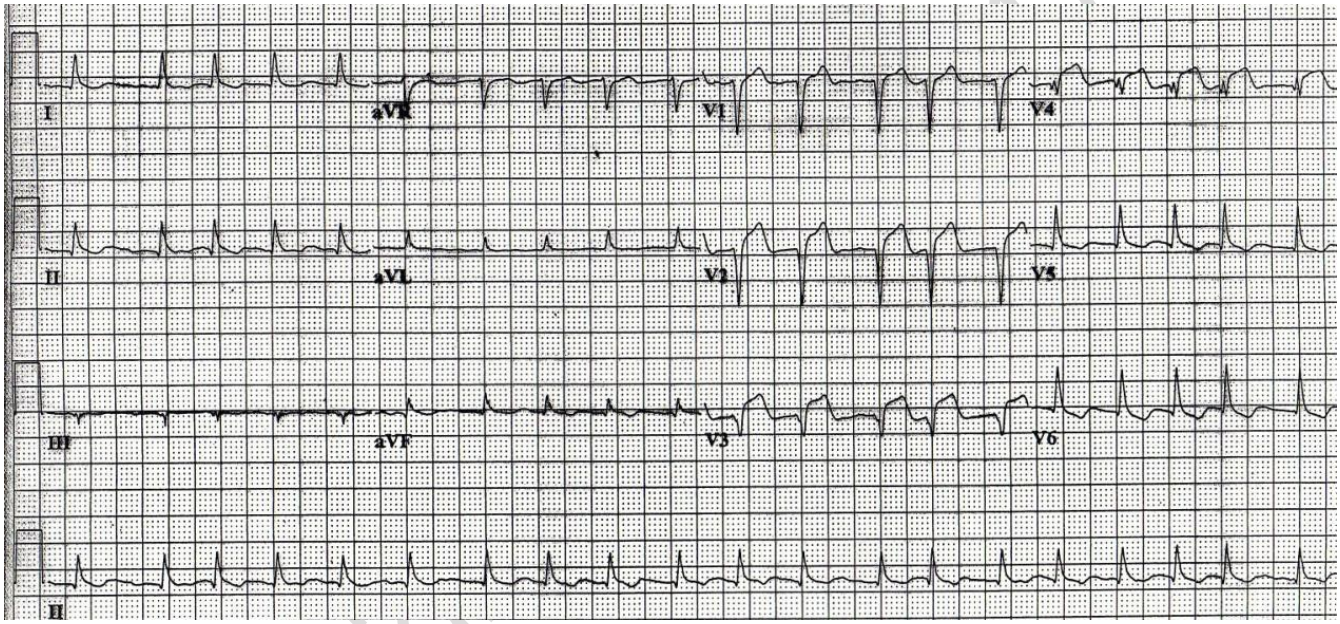
The C wave is the rise in the atrial pressure during isovolumetric contraction. Isovolumetric contraction is the period immediately after the tricuspid valve closes, but before the pulmonary valve opens. During this period, depolarization of the ventricle causes the ventricular pressure to increase until it overcomes the pulmonary artery pressure (the pressure change that is required to open the pulmonary valve). During isovolumetric contraction, the rising ventricular pressure causes the closed tricuspid valve to bulge upward into the atrium. This increases the atrial pressure, producing the "C" wave.

The following right atrial waveform has been labeled to identify the rise in pressure associated with atrial contraction (a wave), the rise in the atrial pressure during isovolumetric contraction (c wave) and the rise in the atrial pressure that occurs when the right atrium refills with blood during ventricular systole (v wave).

Blueprint Competency Being Tested: 2.1d

Interprets data (initial and ongoing assessment or response to interventions) related to the cardiovascular system, including:12-lead ECG (e.g., ischemia, infarction, bundle branch blocks).

87. What does this ECG suggest?



a. Inferior wall infarction
b. Lateral wall infarction
c. Anterior wall infarction
d. Posterior wall infarction

ANSWER C

Rationale for Correct Response:

Q waves and ST elevation are evident in V1-V4, consistent with a Q wave ST segment elevation MI in the anterior wall.

Blueprint Competency Being Tested: 2.3a

Intervenes based on observation of manifestations of the following actual or potential life-threatening alterations in cardiac output and perfusion: cardiogenic shock (e.g., myocardial infarction, cardiomyopathy).

88. Mrs. Arubesque is admitted with cardiogenic shock following a right ventricular myocardial infarction. She has the following findings:

HR 62 BP 80/50 (MAP 60) CVP 24 SpO_2 92%

Which one of the following interventions is the priority?

a. Normal saline bolus
b. Dopamine
c. Furosemide (Lasix)
d. Metoprolol (Betaloc)

ANSWER C

Rationale for Correct Response:

RV infarcts need careful volume assessment and resuscitation. While it is important to have a high enough pressure to fill the right ventricle, it is important not to over distend it. With ventricular interdependence, right ventricle enlargement may shift the septum towards the left ventricle, limiting the ability for the left ventricle to fill.

Blueprint Competency Being Tested: 2.3e

Intervenes based on observation of manifestations of the following actual or potential life threatening alterations in cardiac output and perfusion: cardiac tamponade (e.g., cardiac surgery, trauma, pericardial effusion).

89. Mr. Fillips had an anterior NSTEMI that was treated with PCI and dual antiplatelet therapy. Upon admission, he had a pericardial rub. This morning, he has new onset hypotension, dyspnea and muffled heart sounds, with jugular vein distention. Which intervention is the priority?

a. Pericardiocentesis
b. Aggressive diuresis
c. Intra-aortic balloon pump
d. Coronary angiography

ANSWER A

Rationale for Correct Response:

Hypotension with narrowed pulse pressure, muffled heart sounds and jugular vein distention (or increased CVP) are the three medical signs suggestive of cardiac tamponade (known as Beck's Triad). Pulsus paradoxus may also be present, and there are usually signs of low cardiac output. Pericardiocentesis is the treatment.

Blueprint Competency Being Tested: 3.1g

Interprets data (initial and ongoing assessment or evaluating results of interventions) related to the respiratory system, including: ventilation information (e.g., tidal volume, minute volume, respiratory rate, airway pressures, PEEP).

90. Identify the formula for minute volume (minute ventilation).

a. Tidal volume X respiratory rate
b. Functional residual capacity – tidal volume
c. Forced vital capacity X respiratory rate
d. Cardiac Output X respiratory rate

ANSWER A

Rationale for Correct Response:

Minute volume or ventilation is the total amount of air exhaled in one minute and is calculated as the tidal volume X respiratory rate.

Blueprint Competency Being Tested: 3.1f

Interprets data (initial and ongoing assessment or evaluating results of interventions) related to the respiratory system, including: need for ventilatory support (e.g., non-invasive, indications for intubation and ventilation, readiness for discontinuation).

91. After successful completion of a spontaneous breathing trial, extubation is considered. Which one of the following findings would be a contraindication to extubation?

a. FiO_2 0.4
b. PEEP 5
c. GCS 5
d. Minute volume 10 L/min

ANSWER C

Rationale for Correct Response:

A GCS of 5 indicates a severely depressed level of consciousness. A GCS of this level is typically associated with impaired ability to protect the airway.

Blueprint Competency Being Tested: 2.3h

Intervenes based on observation of manifestations of the following actual or potential life-threatening alterations in cardiac output and perfusion: dysrhythmias.

92. Mrs. Andios is a Type 2 diabetic with a history of TIA and congestive heart failure. She is admitted to the critical care unit for monitoring following a Hartmann's procedure for colon cancer. Two hours postoperatively, she develops new onset uncontrolled atrial fibrillation with hypotension. Which one of the following interventions is the priority?

a. Lidocaine
b. Amiodarone (Cordarone)
c. Coumadin
d. IV Heparin

ANSWER B

Rationale for Correct Response:

Amiodarone may convert atrial or ventricular arrhythmias. Lidocaine will not work on atrial arrhythmias. Although long term anticoagulation is indicated given her other comorbities (DM 2, TIA and CHF) if her atrial fibrillation persists, postoperative bleeding is a greater risk.

For persistent or recurrent atrial fibrillation, rate control is the goal versus conversion to sinus rhythm. Beta blockade is the first line agent for rate control.

Blueprint Competency Being Tested: 1.5g

Selects the appropriate evidence-informed nursing interventions to correct alterations in cerebral tissue perfusion, such as: managing metabolic rate (e.g., cooling devices or fluids, pharmacological agents, reduced stimulation).

93. Mrs. Katanska had a thrombotic stroke 18 hours ago. She has the following findings:

HR 85
BP 165/80 (MAP 108) CVP 13
RR 25
Temp 38.3

Which one of the following pharmacological agents is the priority?

a. Antipyretic
b. Anticonvulsant
c. Antihypertensive
d. Beta-blocker

ANSWER A

Rationale for Correct Response:

Early intervention for fever is recommended following stroke. Fever is associated with worse outcome stroke. Hypertension is only treated when extreme, as the injured brain may need a higher cerebral perfusion pressure. Anticonvulsants are not indicated unless evidence of seizure.

Blueprint Competency Being Tested: 2.3f

Intervenes based on observation of manifestations of the following actual or potential life threatening alterations in cardiac output and perfusion: acute cardiac pulmonary edema (e.g., oxygen, pharmacological agents, PEEP).

94. Mrs. Bennedict has a large anterior-lateral wall ST segment elevation myocardial infarction. She develops severe shortness of breath, orthopnea, pink frothy sputum and jugular venous distention. BP 160/95 HR 135 and RR 32. Which one of the following interventions is a priority?

a. Dobutamine (Dobutrex)
b. Metoprolol (Betaloc)
c. Furosemide (Lasix)
d. Digoxin

ANSWER C

Rationale for Correct Response:

These findings suggest acute pulmonary edema secondary to left sided heart failure. Although beta blockade is a priority following myocardial infarction, the most urgent need is to manage the pulmonary edema with Lasix.

Blueprint Competency Being Tested: 3.1d

Interprets data (initial and ongoing assessment or evaluating results of interventions) related to the respiratory system, including: oxygen value (e.g., PaO2, SaO2, SpO2, oxygen content, PaO2/FiO2 ratio).

95. Calculate the PaO_2:FiO_2 ratio based on the following data:

FiO_2 1.0
PEEP 10
PaO_2 65
pH 7.34
$PaCO_2$ 45
SpO_2 90%

a. .90
b. 20
c. 65
d. 35

ANSWER C

Rationale for Correct Response:

PaO_2:FiO_2 ratio in this example is 65 / 1.0 = 65.

Blueprint Competency Being Tested: 2.4a

Intervenes based on observation of manifestations of the following actual or potential life-threatening alterations of the vascular structure and function: aneurysm and/or dissection (e.g., aortic arch, thoracic, abdominal).

96. Mr. Sinese is admitted with a Type B aortic dissection. His BP is 185/100 with a HR of 100. Which one of the following interventions is the priority?

a. Labetolol (Trandate)
b. Metoprolol (Betaloc)
c. Milrinone (Primacor)
d. Norepinephrine (Levophed)

ANSWER A

Rationale for Correct Response:

Blood pressure control to prevent bleeding is the priority. Type B dissections are located distal to the left subclavian artery and are often managed medically.

Blueprint Competency Being Tested: 3.4b

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: managing airway (e.g., jaw thrust or chin lift, artificial airways).

97. Mrs. Chen has a diagnosis of asthma and is admitted with loud expiratory wheezes that are audible without a stethoscope. Three hours after starting Salbutamol (Ventolin) by inhalation q 1 h and after IV Methylprednisolone is started (Solumedrol), her wheezes disappear and her chest wall movement has decreased. She has the following findings:

RR is 40 SpO2 82% BP 160/95

Which one of the following interventions is the priority?

a. Initiate Ipratroprium Bromide (Atrovent)
b. Initiate Fluticasone/Salmeterol (Advair)
c. Administer Hydralazine (Apresoline)
d. Prepare for intubation

ANSWER D

Rationale for Correct Response:

Sudden cessation of wheezing and decreased chest movement are signs of severe airway obstruction. Intubation is the priority. Advair is an inhaled steroid plus long acting beta adrenergic which is used for long term management and should not be used in acute exacerbations.

While the addition of an anticholinergic bronchodilator (Ipratroprium Bromide) may have synergistic bronchodilating effects, intubation is the priority.

Blueprint Competency Being Tested: 1.3c

*Recognizes actual or potential life-threatening alterations in neurologic function, including: motor and sensory dysfunction related to brain injury (e.g., stroke, traumatic brain injury**).***

98. Darius is injured in a motor vehicle collision. He has a right cerebral contusion, small left subdural hematoma and decreased motor function in his left leg. His left great toe is downgoing, and his patellar and Achilles reflexes (knee and ankle jerk) are 0-1+. Which one of the following problems would explain his left leg weakness?

a. Right cerebral injury
b. Left cerebral injury
c. Acute spinal cord injury
d. Lower motor neuron injury

ANSWER D

Rationale for Correct Response:

He has a motor weakness that is associated with decreased reflexes and down going toe on the affected side, suggesting a lower motor neuron (or peripheral) cause for his leg weakness. Brain or cord injuries are associated with motor weaknesses with increased reflexes and upgoing toe.

Blueprint Competency Being Tested: 3.3c

Recognizes an actual or potential life-threatening alteration of the respiratory system, including: pleural abnormalities (e.g., tension pneumothorax, pleural effusion, hemothorax).

99. Mr. Sing is admitted to the critical care unit with a closed head injury following a fall from a ladder. He develops respiratory distress and has HR 144, RR 38, BP 60/40 and SpO_2 74%. His peak airway pressures increase and his trachea deviates to the right side. Which one of the following interventions is the priority?

a. Mannitol
b. Norepinephrine (Levophed)
c. Right sided chest tube
d. Left sided chest tube

ANSWER D

Rationale for Correct Response:

These findings (hypoxemia, respiratory distress and hypotension), combined with the tracheal shift toward the right side, suggest a left sided tension hemothorax or pneumothorax.

Blueprint Competency Being Tested: 1.1a

Interprets data (initial and ongoing assessment or response to interventions related to the neurologic system), including: physical assessment (e.g., vital signs, level of consciousness, Glasgow Coma Scale, sedation scale, cranial nerve assessment, delirium assessment, pain assessment, motor and sensory assessment, pupils, peripheral nerve stimulation [TOF]).

100. Mrs. Sisko is admitted with atrial fibrillation and is treated with Diltiazem, Metoprolol and Amiodarone. She is cardioverted to sinus rhythm 24 hours after admission, and develops right sided facial droop and right hand weakness 30 minutes later. Which one of the following explanations identifies the most likely cause of these findings?

a. Right cerebral embolus
b. Right cerebral hemorrhage
c. Left cerebral hemorrhage
d. Left cerebral embolus

ANSWER D

Rationale for Correct Response:

Cardioversion for atrial fibrillation carries the risk of thrombotic embolus. The most likely journey would be via one of the carotid vessels to the corresponding middle cerebral artery. The timing and right sided facial and upper extremity symptoms, supports an embolus up the left carotid artery to the left middle cerebral artery (motor function is contralateral). This has caused ischemia (TIA) or infarction (ischemic stroke) to the left cerebral hemisphere.

Blueprint Competency Being Tested: 9.4a

Interprets assessment data (initial and ongoing assessment or response to interventions) related to: pain (e.g., vital sign changes, body language, pain intensity scale, precipitating and palliative factors, quality, radiation/referral, associated signs and symptoms, time, understanding/experience).

101. Mrs. Watson sustains a fractured sternum and multiple fractures of right ribs #3-#6. She is receiving:

FiO_2 0.5
PEEP 10
Pressure Support (PS) 15 cmH_20

She becomes restless with paradoxical chest wall movement and her tidal volumes decrease to 250-300 cc. Which one of the following interventions is the priority?

a. Administer analgesic
b. Suction her endotracheal tube
c. Increase the pressure support
d. Administer sedation

ANSWER A

Rationale for Correct Response:

Pain control is a priority with flail chest. Inadequate pain control leads to chest wall splinting and decreased tidal volumes. The drop in tidal volume with increasing restlessness and paradoxical chest wall movement may be occurring due to splinting and pain. Additional interventions may be required if the patient does not improve with analgesia.

Pain medication should be given before suctioning a patient with a flail chest. Sedatives should be used sparingly as they can contribute to hypoventilation.

Blueprint Competency Being Tested: 3.1a

Interprets data (initial and ongoing assessment or evaluating results of interventions) related to the respiratory system, including: physical assessment (e.g., respiratory pattern, rate, auscultation, palpation, inspection).

102. Which one of the following findings is most suggestive of pulmonary embolus?

a. Hypercarbia, hypoxemia and respiratory distress
b. Normal chest X-ray, severe hypoxemia, and respiratory alkalosis
c. Orthopnea, hemoptysis and pulmonary artery dilation
d. Cardiac enlargement, hypercarbia and increased minute ventilation

ANSWER B

Rationale for Correct Response:

Pulmonary embolus is a problem of impaired perfusion in the setting of normal ventilation (creating a ventilation:perfusion mismatch or increased dead space). Because ventilated lung fields will appear black or "clear" on chest X-ray, pulmonary embolus is often associated with a normal chest X-ray, particularly if the pulmonary embolus is sudden. The chest X-ray is often most useful at ruling out other reasons for hypoxemia**.**

The hypoxemia associated with pulmonary embolus can be secondary to ventilation-perfusion mismatch, intrapulmonary shunts, reduced cardiac output and/or intracardiac shunt via a patent foramen ovale. Hypoxemia will trigger an increase in the minute ventilation. This can lead to over elimination of carbon dioxide (and respiratory alkalosis).

Pulmonary embolus is difficult to diagnose. It is often missed when present and over diagnosed when it is absent. The index of suspicion should be highest among patients with hypoxemia that fails to respond to oxygen or PEEP (this is a blood flow problem).

Rarely, pulmonary embolus can produce a pulmonary infarction. This may appear as a wedge-shaped opacity in the distribution of the blood flow obstruction. The most common radiographic finding associated with pulmonary embolus (that is infrequently seen) is pulmonary artery dilation and/or right ventricular dilation (cardiac enlargement).

Patients in the critical care unit pose important diagnostic challenges. For many of these patients, pulmonary embolus is a complication of another medical condition associated with hypoxemia and abnormal chest X-ray findings (e.g., pneumonia, pulmonary edema, pleural effusion or chronic pulmonary diseases). Consequently, many patients with pulmonary embolus will have an abnormal X-ray.

Blueprint Competency Being Tested: 1.4a

Selects the appropriate evidence-informed nursing interventions to minimize or prevent motor or sensory deficits, such as: maintaining spinal cord integrity (e.g., positioning, immobilization devices).

103. Mr. Liposki was admitted this morning with an acute C5-6 spinal cord injury due to an all-terrain vehicle roll-over. He is currently ventilated and receiving PRN analgesia. When planning his care, which one of the following interventions should be included in the plan?

a. Strict maintenance of cervical, thoracic and lumbar spine alignment
b. Neurological testing of spinal cord function q 12 h
c. Early mobilization to trauma chair with cervical collar
d. Head of bed elevation to 45 degrees with cervical collar

ANSWER A

Rationale for Correct Response:

CTL precautions must be maintained until the cervical, thoracic and lumbar spines have been cleared. Some of the current level of disability may be due to edema with potential for some recovery; good cord alignment promotes maximal recovery and reduces the chance of a secondary injury (from instability, hypotension, hypoxia or hypercarbia) that could increase the level of disability.

Multilevel injury can be present, and lower level injuries can be masked by a brain injury or higher cord injury. For example, there could also be an unstable thoracic level injury without cord involvement. If spinal precautions are not maintained, cord injury at the thoracic level could occur. If some recovery from the cervical level injury occurs in this situation, the cervical recovery could be negated by the new and preventable thoracic level injury.

Neurological testing for spinal cord function should be q1h during the acute phase. This could identify worsening dysfunction that could indicate a need for urgent intervention. Movement to the trauma chair or head of bed elevation to 45 degrees would be contraindicate until stabilization is established.

Mobilization of a patient with an acute spinal cord injury must be done cautiously to avoid autonomic dysfunction due to neurogenic shock, with bradycardia and hypotension.

Blueprint Competency Being Tested: 1.4b

Selects the appropriate evidence-informed nursing interventions to minimize or prevent motor or sensory deficits, such as: intervening in spinal cord crises: spinal shock, neurogenic shock, autonomic dysreflexia (e.g., alleviating cause, pharmacological agents, positioning, fluids).

104. Mr. Bottwa sustained a C6 injury 14 years ago and has chronic narcotic use for neck pain. Two days ago, he was admitted with pneumonia. His blood pressure is 155/60 HR 55 and he has facial flushing and headache. Which one of the following interventions is the priority?

a. Perform assisted cough
b. Administer antihypertensive agent
c. Assess bladder catheter
d. Administer analgesic

ANSWER C

Rationale for Correct Response:

Hypertension, bradycardia, facial flushing and bounding headache are findings of autonomic dysreflexia. Autonomic dysreflexia is triggered by unrelieved stimulation of pain-temperature hypertension. The hypertension triggers inhibition (including vagal slowing of the heart and vasodilation). The inhibition (vasodilation) cannot travel below the level of the cord injury, therefore, vasoconstriction persists below the lesion (causing the hypertension) and vasodilation occurs above the lesion (facial flushing and bounding headache). The most common triggers are bladder or bowel distention due to inadequate evaluation. Although neck pain would be a potential source for painful stimulation, this trigger is above the level of the spinal cord lesion. Alleviation of the causative agent is the priority and will usually relieve the hypertension

Blueprint Competency Being Tested: 1.5a

Selects the appropriate evidence-informed nursing interventions to correct alterations in cerebral tissue perfusion, such as: using techniques to prevent obstruction and promote venous and cerebral spinal fluid (CSF) drainage (e.g., positioning, neck alignment, head-of-bed elevation, proper application of collars, tracheostomy ties).

105. Mr. Dorias was admitted the previous evening following a hypertensive cerebral bleed. He is admitted in deep coma, with midline shift evident on CT. His best motor response is abnormal flexion and he frequently flexes his neck toward his shoulder during abnormal posturing episodes. During these episodes, his SBP increases to > 200 mmHg. Which one of the following interventions is a priority?

a. Administer PRN Hydralazine (Apresoline)
b. Reduce the frequency of neurological testing
c. Minimize the frequency of family visits
d. Maintain neutral neck alignment using a cervical collar

ANSWER D

Rationale for Correct Response:

Neck alignment promotes cerebral venous drainage. Flexing of the neck toward the shoulder can decrease venous outflow and increase ICP. Stabilization of the neck in this example may help to reduce ICP.

The hypertension may be a sign of increased ICP, venous drainage obstruction or due to stimulation. The hypertensive episodes may be maintaining cerebral perfusion pressure. Treatment of the hypertension would only be considered if the hypertension is sustained and raised ICP as a cause has been ruled out. Neurological testing should continue on an hourly basis in an acute injury. There is no evidence that family visits are harmful; families should be educated regarding the plan of care to facilitate support of the plan during their visits.

Blueprint Competency Being Tested: 3.3f

Recognizes an actual or potential life-threatening alteration of the respiratory system, including: pulmonary hypertension (e.g., primary, secondary).

106. Mrs. Talovsky developed idiopathic pulmonary hypertension following the birth of her second child 5 years earlier. She was admitted with cyanosis. She is mechanically ventilated with the following findings: SpO2 75%, HR 144, BP 105/60 and PAP 82/45. Which one of the following interventions is the priority?

a. Prostacyclin (Flolan)
b. Norepinephrine (Levophed)
c. Increased PEEP
d. Epinephrine (Adrenalin)

ANSWER A

Rationale for Correct Response:

Pulmonary vasoconstriction is believed to be the primary mechanism of pulmonary hypertension. Hypoxemia is a potent trigger of vasoconstriction, worsening the pulmonary hypertension. Right to left shunting of blood (due to high right to left pressure gradients) accounts for much of the hypoxemia. Prostacyclin is a potent pulmonary vasodilator with an ultra-short half-life. It is administered by a continuous infusion (chilled). Sildenafil citrate (Viagra) can also be used to promote pulmonary venous dilation. Pulmonary hypertension can also be treated with inhaled Nitric Oxide (NO).

Norepinephrine or Epinephrine may help to raise systemic BP, which in theory should improve the arterial to venous blood flow. Unfortunately, the gradient rarely improves with alpha stimulation because the pulmonary pressures will also increase.

PEEP will have minimal benefit since alveolar collapse is not the primary problem.

Blueprint Competency Being Tested: 3.4f

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: administering pharmacological agents to facilitate ventilation (e.g., analgesics, reversal agents, sedatives, paralytics, puffers/aerosol therapy).

107. Ms. Kelver is admitted with status asthmaticus. Immediately following intubation, she is manually ventilated using a bag-mask apparatus. She becomes very difficult to ventilate, requiring increasing effort to inflate her lungs with each manual breath. Which one of the following interventions is the priority?

a. Initiate mechanical ventilator with Pressure Control mode
b. Initiate ventilation with High Frequency Oscillatory Ventilation (HFOV)
c. Disconnect the bag-mask valve and assist exhalation with manual chest pressure
d. Administer Salbutamol (Ventolin) STAT via endotracheal tube

ANSWER C

Rationale for Correct Response:

Asthma is associated with air trapping and hyperinflation. During manual ventilation, rapid rates and/or high tidal volumes can precipitate over distention in the setting of air trapping. Disconnecting the bag-mask-valve apparatus with the application of manual exhalation assistance may facilitate exhalation and lung deflation.

Blueprint Competency Being Tested: 1.5f

Selects the appropriate evidence-informed nursing interventions to correct alterations in cerebral tissue perfusion, such as: managing vasospasm (e.g., calcium channel blockers, triple H therapy [hypervolemia, hypertension, hemodilution], positioning)

108. Mrs. Catalia, 45 years of age, had a clipping of a ruptured left middle cerebral artery aneurysm 5 days earlier. She had been obeying with her right side at previous assessments but is now only localizing. Her GCS has decreased from 12 (eye opening 3, verbal 3, motor 6) to 7 and a repeat CT is negative for edema or bleeding. Her BP is 145/84 (MAP 104), HR 80, CVP 13 and urine output 100 ml/hr. What intervention is the priority?

a. Head of bed elevation
b. Fluid bolus
c. Mannitol bolus
d. Nifedipine (Adalat) q 4 h

ANSWER B

Rationale for Correct Response:

Fluid is one component of the 3 H therapy used in the management of vasospasm.

Vasospasm (cerebral blood vessel narrowing) is a phenomenon most commonly associated with subarachnoid hemorrhage due to aneurysm rupture. Arterial blood vessels are located in the subarachnoid space, therefore, a ruptured aneurysm is a common cause for subarachnoid hemorrhage (but not the only cause). The breakdown of subarachnoid blood and release of calcium has been implicated as the cause for cerebral vasospasm. The usual timeline is 4-11 days post bleed.

This patient has the appropriate timeline for vasospasm. Worsening level of consciousness could be due to decreased cerebral blood flow from the vasospasm, stroke, cerebral edema or rebleeding. CT ruled out edema and bleeding, making vasospasm the most likely cause.

The treatment for vasospasm is to increase cerebral blood flow by raising the mean blood pressure. Although not well supported by research evidence, 3H therapy is used to promote perfusion into these resistant intracranial blood vessels. The components

of 3 H therapy are (hemodilution, hypervolemia and hypertensive therapy). As well, relaxation of the cerebral blood vessels with the calcium channel blocker Nimodipine is the current standard of care. Cerebral blood flow can be enhanced by positioning the bed flat and avoiding fluctuations in blood pressure; 45 degree elevation would be contraindicated during acute vasospasm.

Mannitol is only indicated for cerebral edema. Administration to a patient with vasospasm could cause dehydration and worsening of vasospasm and ischemia. Nifedipine is not a systemic versus cerebrovascular calcium blocker.

Blueprint Competency Being Tested: 3.4k

Selects appropriate evidence-informed nursing interventions to correct alterations in respiratory function, such as: recognizing the need for changes to ventilatory support (e.g., oxygenation, tidal volume, PEEP, mode).

109. Mr. Zelenick is receiving FiO_2 .5 PEEP 10 and Pressure Control Ventilation with a RR of 18. Which one of the following alarms could be produced by biting on the endotracheal tube?

a. High pressure
b. Low tidal volume
c. High minute volume
d. Auto PEEP

ANSWER B

Rationale for Correct Response:

Biting on the tube would prevent the delivery or decrease the amount of the tidal volume. A high-pressure alarm would be typical if the patient was on volume ventilation; the peak pressure is fixed with Pressure Control.

Blueprint Competency Being Tested: 2.6f

Selects appropriate evidence-informed nursing interventions to correct alterations in cardiac output, such as: managing a cardiac arrest (e.g., advanced cardiac life support [ACLS] protocols, therapeutic hypothermia).

110. Mrs. Sidiki experienced a cardiac arrest with a 15 minute downtime before return to spontaneous circulation. She has a GCS of 5 at admission, with a BP of 110/60, HR 118 on full ventilation. Which one of the following interventions is the priority?

a. Phenytoin (Dilantin)
b. Glucose
c. Hypothermia
d. Haloperidol (Haldol)

ANSWER C

Rationale for Correct Response:

Mild therapeutic hypothermia, introduced immediately following a cardiac arrest (ideally prehospital), can improve neurological outcomes. Her neurological findings are most likely due to cerebral ischemia.

Blueprint Competency Being Tested: 1.5h

Selects the appropriate evidence-informed nursing interventions to correct alterations in cerebral tissue perfusion, such as: managing seizure activity (e.g., pharmacological agents, correcting hypoglycemia, correcting electrolytes).

111. Mrs. Chin is in the critical care unit being treated for severe sepsis due to pneumonia. She is on FiO2 0.6 PC 16 set RR 25 PEEP 18. She is on Norepinephrine, Vasopressin, and insulin infusions, and is receiving Hydrocortisone q8h. She suddenly has a tonic-clonic generalized seizure. Which one of the following interventions is the priority?

a. Phenytoin (Dilantin)
b. Magnesium Sulphate bolus
c. Hypertonic Saline administration
d. Blood glucose assessment

ANSWER D

Rationale for Correct Response:

Hypoglycemia is an important cause for seizures. High index of suspicion must be maintained when using intensive insulin. If a blood sugar can be measured STAT, this is an appropriate action. If a glucometer is not immediately accessible, 50% dextrose should be administered empirically STAT. Hypoglycemia can be very harmful to the brain, whereas, the unnecessary administration of glucose if the blood sugar is adequate is considered less harmful.

Dilantin may be indicated if there is no reversible cause, but benzodiazepines are the first line anticonvulsants. Definite treatment for hypoglycemia (dextrose 50%) and benzodiazepines for the rapid onset of anticonvulsant activity are first line agents for new seizure.

Blueprint Competency Being Tested: 2.6a

Selects appropriate evidence-informed nursing interventions to correct alterations in cardiac output, such as: optimizing preload (e.g., fluid administration, pharmacological agents).

112. Mrs. Caplin is 18 hours post cardiac arrest and being treated with therapeutic hypothermia. She remains non-responsive, with a BP of 85/45 (MAP 58), HR 80, CVP 10, Temp 33, urine output 25 ml/hr, SpO2 95% on FiO2 .4 PEEP 5 and set RR 18. Which one of the following interventions is a priority?

a. Dopamine (Intropin)
b. Fluid bolus
c. Beta blocker
d. Increase the PEEP

ANSWER B

Rationale for Correct Response:

She is in a high-risk period for cerebral edema secondary to her hypoxic insult. Edema can worsen during the initial 2-4 days. Preventing secondary injury by maintaining adequate cerebral perfusion pressure, and by preventing hypoxemia, hypercarbia and hypoglycemia is essential.

Her mean BP is low with a marginal urine output. Her HR is fast given her hypothermia. Her CVP is 10 while ventilated. A fluid bolus should be administered to identify whether volume deficit is the cause for the clinical findings. Correction of the marginal BP is important to ensure adequate cerebral perfusion. If there is no response to fluid, inotropes and/or vasopressors may be required.

Although beta blockers are indicated following myocardial infarction, they may decrease contractility and worsen her cerebral perfusion given her marginal BP. Because of the myocardial depression associated with hypothermia, beta blockers are generally started after the period of hypothermia. She needs to have a stabilized BP before initiating beta blockers, with careful monitoring of cerebral perfusion.

Hypoxemia and hypercarbia should also be treated, however, an SpO2 of 95% is adequate.

Blueprint Competency Being Tested: 3.6

Selects appropriate evidenced-informed nursing interventions to optimize oxygenation and ventilation.

113. Mr. Evans has ARDS and is on the following ventilator settings:

FiO_2 0.5 PEEP 12 set RR 22 Volume Controlled ventilation with VT 450 cc.

Blood gases are: PaO_2 64 PCO_2 60 pH 7.20 HCO_3 26.

Which one of the following interventions would be the priority?

a. Increase the PEEP
b. Increase the Tidal Volume
c. Change to Pressure Control Ventilation
d. Increase the RR rate

ANSWER D

Rationale for Correct Response:

These gases reveal a respiratory acidosis, indicating that the minute volume is not sufficient to meet the CO_2 clearance needs.

Minute volume = TV X RR.

In this example, the minute volume is 9.9. Interventions to increase the total minute ventilation are needed. Increasing the tidal volume or increasing the RR rate would increase the minute ventilation. Because protective lung ventilation for ARDS includes restricting the tidal volume size, increasing the RR rate is the most appropriate action.

Although higher PEEP is recommended for the management of ARDS (to recruit additional alveoli and improve oxygenation), the PEEP is already 12 and the current PaO_2 of 64 would be considered acceptable in the setting of protective lung ventilation.

PC is one method for determining when a breath is terminated, and it is often used in ARDS. The peak pressure and inspiratory time are set to limit the tidal volume size and protect against high inspiratory pressures. While this is commonly used in many ICUs, conversion to PC in itself will not change the minute volume and blood gases (unless the tidal volume or AC (RR) are also changed).

Blueprint Competency Being Tested: 1.5j

Selects the appropriate evidence-informed nursing interventions to correct alterations in cerebral tissue perfusion, such as: managing thrombotic stoke (e.g., thrombolytics, blood pressure control, thermoregulation, blood glucose control).

114. Mrs. Vanelli develops witnessed onset of aphasia. One hour later, an urgent CT rules out cerebral hemorrhage. Vital signs are:

BP 156/70 (MAP 90)
HR 105 (atrial fibrillation)
RR 26
Glucose 10.2
Temp 36.8

What is the priority?

a. TnK (Tenectaplase)
b. tPA (Alteplase)
c. Heparin
d. Insulin

ANSWER B

Rationale for Correct Response:

Thrombolysis with tPA is indicated for acute ischemic stroke (hemorrhage ruled out) with symptom onset < 4.5 hours, in the absence of severe hypertension or bleeding risk. Currently, tPA is the only thrombolytic that has been studied in stroke.

Blueprint Competency Being Tested: 2.3e

Intervenes based on observation of manifestations of the following actual or potential life-threatening alterations in cardiac output and perfusion: cardiac tamponade (e.g., cardiac surgery, trauma, pericardial effusion).

115. Two hours following open heart surgery for aortic valve replacement, Mr. Kiefer's BP increases from 110/60 to 150/90 despite analgesia. His HR is 75 and urine output 150 ml/hr. Which one of the following interventions is the priority?

a. Antihypertensive
b. Monitoring only
c. Fluid bolus
d. Anticoagulation

ANSWER A

Rationale for Correct Response:

Hypertension in the early postoperative period after heart surgery increases the risk for bleeding or dissection at the aortic cannulation site. Aortic valve replacement increases this risk. Anticoagulation is required if a mechanical valve is used, however, it is not started immediately postoperative due to the risk of bleeding.

Blueprint Competency Being Tested: 8.5

Selects appropriate evidence-informed nursing interventions to encourage mobilization and prevent complications related to immobility (e.g., range of motion, positioning, therapeutic surfaces, coughing, deep breathing, wound care, splinting, mobilization, minimal restraints, fall prevention).

116. Mrs. Brown required full ventilation for 10 days. She is now hemodynamically stable with adequate blood gases on FiO_2 0.4 and Pressure Support 16. Which one of the following interventions should be included in her plan of care?

a. Anxiolytics
b. Mobilization
c. Prophylactic antibiotics
d. Saline instillation with suctioning

ANSWER B

Rationale for Correct Response:

Liberation from the ventilator includes strategies to promote muscle rest and recovery (e.g., sleep, delirium management, adequate enteral nutrition, glycemic control), early mobilization (breathing trials, chair sitting, weight bearing and ambulation on ventilator), prevention of VAP (head of bed elevation, oral hygiene, use of EVAC tubes, avoidance of nasal gastric tubes, early liberation from ventilator), appropriate/minimal use of sedation.

There is no evidence to support the use of prophylactic antibiotics, rather, inappropriate use may lead to the emergence of antibiotic resistant organisms. Anxiolytics are only indicated if anxiety is impacting weaning. There is no evidence that routine saline instillation is beneficial; it may increase hypoxemia.