Section Two: **2007**

EMT-BASIC
LEARNING OBJECTIVES

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EMT-BASIC
LEARNING OBJECTIVES
SECTION TWO

AIRWAY ANATOMY and PHYSIOLOGY

1. Trace the pathway of a molecule of oxygen as it enters the respiratory system. Begin with the nasopharynx and end with the alveoli:

   - Oxygen enters through the oropharynx or the nasopharynx, passes through the hypopharynx, next past the epiglottis, through the larynx – past the vocal cords, and enters the trachea. Then it enters the mainstem bronchi, descends through the bronchioles, and ends up in the alveoli where gas exchange takes place.

2. Describe the process of "ventilation" and differentiate it from the process of "respiration":

   - Ventilation is a "mechanical" process that occurs when the diaphragm contracts and moves downward causing a negative pressure in the thoracic cavity. Air enters the respiratory system as described above and when the diaphragm relaxes air is forced out of the thoracic cavity.
   - Respiration takes place at the alveolar level as oxygen is on-loaded to cells in the pulmonary capillaries, and carbon dioxide and waste products are off-loaded to be exhaled.
   - Simply stated – Ventilation is the mechanical process of inhalation and exhalation (moving the air into and out of the lungs), while respiration is the process of gas exchange.

AIRWAY ASSESSMENT

1. List at least four (4) signs of respiratory distress:

   - cyanosis
   - labored or shallow breathing
   - excessively rapid rate
   - excessively slow rate
   - absence of chest rise
   - use of accessory muscles
   - presence of abnormal sounds (i.e. stridor, rales, etc.)
   - nasal flaring
   - grunting
   - head bobbing

2. Describe how the mechanism of injury dictates how an airway is managed and give specific examples:

   - *Any mechanism that could result in spinal injury will dictate that C-spine precautions are observed when managing the airway. (i.e. patient thrown from vehicle, unconscious for unknown reasons, a diving accident, or motor vehicle collision). All of these patients should have their airway opened with a jaw thrust.*

3. Describe what a **stoma** is:

   - *A surgical opening in the skin of the neck that provides a direct path for air from the trachea to the outside.*

4. Explain the rationale for basic life support ventilation taking priority over other life support skills (ABC):

   - *Lack of ventilation will injure the patient much more than dropping a Combitube. Taking immediate action in maintaining ventilations will allow for oxygen to reach the brain, provided there is adequate circulation, and keeps the brain viable.*

AIRWAY MANAGEMENT

1. Describe two acceptable methods of opening an airway, and indicate the circumstances in which each would be used:

   - *Jaw thrust: used when spinal injury is suspected*
   - *Head tilt/chin lift: used when NO possibility of spinal injury exists*

2. Describe the steps in performing a jaw thrust:

   - *After carefully placing the patient in a supine position, move to the patient's head and rest your elbows on the same surface the patient is laying. Place one hand on each side of the patient's lower jaw. While stabilizing the head with your forearms, slowly lift the jaw upwards, keeping the head and neck stabilized. Do not tilt or rotate the head while performing this maneuver.*

3. What are some strategies for handling a patient with difficulty breathing or distress:

   - *Understand that it is hard to communicate when you are having trouble breathing. Begin by reassuring the patient that you are there to help them. Calm them by coaching their breathing to a reasonable rate. Provide oxygen to them at a rate they will tolerate and avoid going straight for the BVM to slow the respiratory rate. Do your best to calm them and allow the oxygen to do its job.*

4. Describe the techniques used to assess for the presence of breathing:

   - LOOK for chest rise, LISTEN for sounds of breathing, FEEL for air coming from the mouth/nose.

5. Identify the parameters used to determine the adequacy of breathing (ventilation):

   - Both RATE and DEPTH must be sufficient to determine adequate respiratory effort.

6. Describe one way to asses for the presence of a gag reflex:

   - Lightly brush patient's eyelashes with your fingertip. If the eyelashes flutter, then the patient is not deeply unconscious and probably still has a gag reflex.

7. Describe the management of a vomiting patient. How would this be complicated by a possible spinal injury?

   - Turn patient's head to the side and clear mouth with suction. If you suspect a spinal injury and patient is not yet backboarded, then the patient's whole body must be turned as a unit, which requires several people. If the patient is backboarded, then the entire board should be turned.

8. Describe the correct use of suction to clear a patient's airway:

   - Suction until airway is clear and patient can be ventilated.
   - Suction only as far as you can visualize (i.e. DO NOT suction trachea).
   - Avoid suction of patient's tongue and lining of mouth.

9. Describe how to ventilate a patient with a stoma:

   - Neither the head-tilt chin-lift nor the jaw-thrust maneuver is required for ventilating a patient with a stoma. If the patient has a tube in the stoma, you should ventilate through the tube. Optimally you should seal the patient's mouth and nose with one hand to prevent a leak of air up the trachea when you ventilate through a tracheal tube or stoma and then release the seal of the patient's mouth and nose for exhalation, however this is very difficult to do without multiple rescuers. A pediatric mask makes it easier to obtain a good seal.

10. List the indications, contraindications, procedures, and special concerns for the use of an oropharyngeal airway:

    - *Oropharyngeal airways are indicated for unconscious patients without a gag reflex whose tongue continues to fall back and occlude the airway. OPA's must be measured properly (corner of mouth to earlobe) and inserted tip up until resistance is met, then rotated 180 degrees. Flange should rest on lips or teeth. OPA's are not recommended for infants, or small peds unless the correct size is available.*

11. List the indications, contraindications, procedures, and special concerns for the use of a nasopharyngeal airway:

    - *Nasopharyngeal airways are indicated for conscious or unconscious patients with potential airway compromise. NPA's must be correctly sized for length (earlobe to center of nose) and diameter, and should be lubricated with water based lubricant. Insertion should follow the natural curve of the NPA (toward back of throat – not up).*
    - *NPA's should not be used in patients under 8 years of age or in patients with severe facial trauma (especially to the nose).*

12. Define endotracheal intubation, list its advantages, and indicate three types of patients who would benefit from this advanced life support (ALS) airway procedure. How will a need for endotracheal intubation affect the patient's management at the BLS level?

    - Endotracheal intubation consists of passing a tube directly into the trachea. If the tube is passed through the mouth, the procedure is known as orotracheal intubation. If the tube is passed through the nose, the procedure is known as nasotracheal intubation. The endotracheal (ET) tube is open at both ends. The proximal end has a standard 15 mm adapter for a BVM or automatic ventilating device. The distal end has an inflatable cuff, which effectively seals off the airway when inflated. Intubation is the most effective means to achieve complete control of the airway, and offers the following advantages:
    - *The inflated cuff protects the airway from aspiration.*
    - *Ventilation through an ET tube does not cause gastric distension.*
    - *The ET tube provides access for direct suctioning of the tracheobronchial tree.*
    - *The ET tube maintains a patient's airway in patients who continue to suffer obstruction despite use of an OPA or NPA.*
    - *The ET tube provides a route for medication administration.*
    - *Any patient whose airway is threatened may be a candidate for intubation, i.e.: - Any patient in cardiac arrest*
      - Any unresponsive patient without a gag reflex

- Patients whose airway may become obstructed (i.e. patient with burns to the airway, or in progressive anaphylaxis)
- A patient's need for intubation should be recognized such by the EMT-Basic, and should affect the BLS management such that the EMT-Basic should call for ALS personnel to respond or intercept the BLS unit.

OXYGEN ADJUNCTS

1. Describe the purpose of the following:

   - *Oxygen regulator: regulates amount of oxygen coming out of tank.*
   - *O-ring: provides seal between tank valve and regulator.*
   - *Oxygen wrench: used to open valve on tank.*

2. Differentiate between the LPM and the PSI gauges. What does each gauge indicate?

   - *The LPM gauge indicates the liters per minute of oxygen being delivered.*
   - *The PSI gauge indicates the amount of pressurized oxygen still remaining in the tank.*

3. List three (3) safety concerns/precautions when handling oxygen tanks:

   - *Watch exposure to heat/flame.*
   - *Handle tanks carefully (i.e. lay on side).*
   - *NO petroleum products on fittings.*

SUPPLEMENTAL OXYGEN

1. Identify the indications for supplemental oxygen. Describe 2 situations each where high flow and low flow oxygen would be appropriate:

   - *Supplemental oxygen is indicated for any patient in respiratory distress. High flow is indicated for patients in severe respiratory distress due to trauma, shock or medical emergency. Low flow oxygen is given to those patients in milder respiratory distress, with dizziness, nausea, headache or minor trauma.*

2. Explain the rationale for delivering high flow oxygen to a patient who previously received lower concentrations:

- The higher flow of oxygen will augment their circulating O_2 levels, providing more oxygen to the tissues.

3. For each of the following oxygen devices list the indications, the approximate range of liter flow, and the precautions, if any:

Nasal cannula (NC): *mild respiratory distress, low flow device, 2 – 6 lpm.*

Simple face mask (SFM): *mod. respiratory distress, low to moderate flow device, 6 – 10 lpm.*

Partial rebreather mask (PRB): *more severe respiratory distress, high flow device, 8 – 15 lpm – enough to keep bag inflated 2/3 when patient inhales.*

Non-rebreather mask (NRB): *severe respiratory distress, high flow device, 10 – 15 lpm, use caution – if Oxygen tank goes empty, there's no air available to the patient.*

Bag valve mask (BVM): *for non-breathing or patient needing assistance. Can be used without oxygen but is usually used with high flow, at least 15 lpm.*

Demand valve: *non-breathing patient or patient that can hold mask themselves. Uses 100% oxygen. Caution needed since depressing button too long can overinflate lungs.*

Pocket mask: *Usually used for mouth to mask ventilations without oxygen. However, many pocket masks have an oxygen inlet valve, which increases the percentage of O_2 available to the patient.*

Automatic Transport Ventilator (ATV): *These are devices that are designed to deliver preset and exact tidal volumes at pressures low enough to avoid the esophageal opening pressures. The devices also deliver an exact number of ventilations per minute. All of them offer the advantage of hands free operation, which allows the rescuer to use two hands to maintain the mask seal. These devices are Oxygen powered/driven and require a 50 psi oxygen source for operation. They also provide 100% oxygen delivery to the patient.*

Manually Triggered Ventilator (MTV): *This is a flow restricted, oxygen powered "demand valve" that has been modified to limit the amount of oxygen it can deliver to 40 liters per minute. They can deliver large tidal volumes at low pressure, providing 100% oxygen to the patient. These too require a 50 psi oxygen source.*

MULTI-LUMEN AIRWAY (MLA)

1. Explain the purpose of using a Multi-Lumen Airway:

   - *To help prevent emesis/aspiration.*
   - *To provide an airway for use with a BVM or automatic ventilation device.*
   - *To help prevent gastric distention.*

2. Identify two (2) common types of MLA's:

   - *Combitube*
   - *PTL (Phayngeal/Tracheal Lumen Airway)*

3. List the indications and contraindications for the use of the MLA:

   INDICATIONS:
   - *Unconscious.*
   - *No gag reflex.*
   - *Usually respiratory/cardiac arrest.*

   CONTRAINDICATIONS:
   - *Conscious patient or patient with intact gag reflex*
   - *P – pt. Parameters – too small, less than 5', under 16 y.o.*
   - *L – pt. with Laryngectomy*
   - *A – pt. with Airway obstruction*
   - *C – pt. that has ingested a Caustic substance*
   - *E – pt. with known Esophageal disease*

   CONSIDERATION:
   - *S – Sharp objects in mouth (i.e. broken teeth, need to be careful during insertion).*

4. List the advantages and disadvantages of the MLA:

   ADVANTAGES:
   - *Helps prevent aspiration*
   - *Improper tube placement OK since then it can be used as an ET tube.*
   - *May control bleeding and aspiration secondary to oral trauma.*

   DISADVANTAGES:
   - *May be more difficult for ALS to intubate around.*
   - *May be difficult to recognize which tube to ventilate.*

5. Describe the conditions in which removal of the MLA should be considered:

   - *Possible after intubation.*
   - *Pt. regains consciousness (or gag reflex).*

6. Given a diagram of a MLA, the student should be able to label and describe the function of all component parts:

7. List the equipment needed for insertion of the MLA, including recommended personal protection:

   - *Oxygen, oral or nasal airway, MLA, water soluble lubricant, BVM, gloves, eyewear, face mask, stethoscope.*

8. List the steps for insertion of the MLA in the proper order according the skill sheet:

   - *See skill sheet.*

9. List the steps for removal of the MLA in the proper order according to the skill sheet:

   - *See skill sheet.*

10. Identify the possible complications of using the MLA:

    - *Esophageal rupture.*
    - *Ventilation of the wrong tube.*

LARYNGEAL AIRWAY DEVICES

1. List the purpose, indications, contraindications, advantages, disadvantages and possible complications of a Laryngeal Airway Device

Purpose:

It provides an airway for use with a BVM.
It helps prevent gastric distention.

Indications:

The Device is indicated for airway control in the absence of other effective methods.
Patients will usually be unconscious, with no gag reflex, and/or unable to protect their own airway
Most patients will probably be in respiratory or cardiac arrest

Contraindications:

Conscious patient
Patient with intact gag reflex
Ingestion of a caustic substance may be a concern. Contact your MCEP for advice.

Advantages:

Easy to use, and it is easier to ventilate a patient with this device in place, as compared to attempting to maintain a seal with a BVM. Helps prevent aspiration and/or gastric distension. However, aspiration is still a risk with this device, as the trachea is not "sealed off".

Disadvantages:

This device must be removed for ALS to intubate the patient.
It does not completely seal off the trachea and protect the patient from aspiration.

Possible Complications:

Unrecognized aspiration
Not utilizing the correct size. If the sizing is not correct, the tendency will be to over-inflate the cuff to achieve an adequate seal. It is better to use a large size with small inflation volumes than a small size excessively inflated. An overinflated cuff contributes to increased chance of leaking, gastric insufflation, and poor positioning of the airway.

2. Identify three (3) types of Laryngeal Airway Devices:

1. LMA – Laryngeal Mask Airway
2. King LT-D Airway
3. Cobra Airway

Age and Size Parameters for the LMA Unique (the "Unique" is a version used for the prehospital environment):

Mask Size	Patient Selection	Maximum Cuff Volume
1	Neonates/Infants up to 5 kg	Up to 4 ml
1-1/2	Infants 5 – 10 kg	Up to 7 ml
2	Infants/Children 10 – 20 kg	Up to 10 ml
2-1/2	Children 20 – 30 kg	Up to 14 ml
3	Children 30 – 50 kg	Up to 20 ml
4	Adults 50 – 70 kg	Up to 30 ml
5	Adults 70 – 100 kg	Up to 40 ml

3. List, in order, the steps for insertion and removal for the Laryngeal Airway Device:

   - *See skill sheet*

ARTIFICIAL VENTILATION

1. State the inspiratory time recommended by the American Heart Association (AHA):

   - *1 second*

2. State the ventilatory rate recommended by the AHA:

   - *10 to 12 breaths per minute*

3. Explain the importance of tidal volume and minute volume:

   - *The adequacy of breathing is determined by evaluating these two parameters, tidal volume and minute volume. The tidal volume times the respiratory rate is equal to the minute volume. The normal respiratory rate of 12-20 breaths per minute and tidal volume of approximately 500 ml gives us a minute volume of 6000 to 10000 ml per minute. It is impossible to accurately estimate the tidal or minute volume in the field, but generally, a well defined visible chest expansion indicates a tidal volume of 700 ml in the average adult.*
   - *NOTE: Two of the most important things an EMT can observe in the dyspneic patient are the patient's rate and depth of respirations, which can give the EMT a good estimate of the patient's tidal and minute volumes. In the case of assisting the respirations of a severely dyspneic patient, watching the chest for expansion can help the EMT make sure that adequate tidal volumes are being delivered.*

4. Describe the result of high ventilatory pressures:

   - *High ventilatory pressures open the lower esophageal sphincter (cardiac sphincter) allowing air to enter the stomach resulting in gastric distention. In an unsecured airway, the Sellick technique (or cricoid pressure), can help reduce the risk of gastric distension during ventilation.*

5. List three (3) negative consequences of gastric distention:

   - *Reduced blood return to the heart.*
   - *Reduced tidal volume.*
   - *Increased chance of vomiting.*

PULSE OXIMETRY

1. Explain what Pulse Oximetry measures and define the normal range for a healthy patient:

   - *Using both red and infrared light, a pulse oximeter measures the percent of hemoglobin in the blood that is saturated (occupied) – hopefully with Oxygen. 100% saturation means that all of the hemoglobin (Hgb) is carrying something, hopefully oxygen. Normal range is 95 – 100%.*

2. Explain the procedure for using a pulse oximeter:

   - *Attach probe to finger, toe, or earlobe. Fit must be close or stray light may affect the reading (drape towel over patient's extremity?). Heavily opaque nail polish (esp. metallic flakes) can cause a falsely low reading. Wait until pulse rate stabilizes, confirm that pulse on unit matches patient's actual pulse.*

3. List three (3) circumstances that could cause inaccurate readings (excluding nail polish and stray light), explain whether the reading would be falsely high or falsely low, and why in each case:

   - *Carbon monoxide poisoning: because carbon monoxide uses the same space on the hemoglobin that oxygen does (unlike carbon dioxide), reading is falsely high because the machine reads only the percent of saturated hemoglobin. It does not differentiate between oxygen and carbon monoxide.*

   - *Poor perfusion in extremities: i.e. in advanced diabetes, reading is falsely low.*

   - *Motion of the limb can cause either loss of signal or falsely low reading.*

4. List three (3) circumstances when the patient could be in trouble, yet the O_2 saturation would appear normal, and explain why in each case:

   - *Carbon monoxide poisoning: see above*
   - *Hypovolemia: because of blood loss, patient may not have adequate amount of hemoglobin, even if <u>all</u> of it is saturated with oxygen.*
   - *Anemia: see hypovolemia above*
   - *Patient with shallow respirations, supplemental O_2 may increase O_2 to normal levels, but the patient is still accumulating CO_2 which leads to acidosis.*

5. Describe a situation when pulse oximetry would be appropriate in the prehospital setting, and indicate its place in the treatment of the patient:

   - *Monitoring the effects of oxygen therapy on a patient in respiratory distress, i.e. asthma, COPD.*
   - *Use of a pulse oximeter should NEVER delay treatment of a patient, nor should it become the sole means of assessment. Machines are fallible, and the EMT should rely on their assessment skills to determine the adequacy of patient oxygenation. Remember to treat the <u>patient</u>, not the <u>machine</u>!*

BLEEDING

1. Describe the characteristics of:

   -*<u>Arterial Bleeding</u>: bright red, under pressure, spurts in time with pulse*

   -*<u>Venous Bleeding</u>: dark red, steady flow, does not spurt (not under pressure)*

   -*<u>Capillary Bleeding</u>: steady oozing, med. red*

2. Briefly explain how you would tell the difference between an/a:

   -*<u>Immediately life-threatening bleed</u>:*
   - May be arterial or venous, but most arterial bleeds should be considered life threatening. The important factor is amount and time. A rapid loss of large volume (i.e. 10% and greater) is <u>immediately</u> life threatening.

   -*<u>Serious bleed</u>:*
   - Usually venous or lesser arterial bleed. Volume and time are still factors, but quantity is usually less over a longer period of time.

   -*<u>Minor bleed</u>:*
   - Usually capillary or lesser venous bleed. Many scalp wounds fall in this category, although they look worse. Easily controlled, insignificant amount.

3. List, in order, the steps used to control serious bleeding:

   1. Direct pressure
   2. Direct pressure combined with elevation (of an extremity)
   3. Temporary tourniquet (if pressure and elevation ineffective)
   4. Pressure dressing (if temporary tourniquet <u>is</u> effective and is removed)
   5. Pressure Points
   6. Long term tourniquet (if bleeding still continues)

- ***NOTE*** *The majority of bleeds can be controlled via direct pressure or a combination of direct pressure and elevation.*

- *If these methods are ineffective, a temporary tourniquet may stop the bleeding enough to allow the EMT time to deliver the patient to the hospital or get assistance to continue with direct pressure. Long-term tourniquets are still considered a <u>last</u> <u>resort</u>, but should be used before allowing the patient to bleed to death!*

4. Compare and contrast a temporary tourniquet to a permanent tourniquet:

   - *A temporary tourniquet is to be used when direct pressure and elevation are proving ineffective and/or the EMT is short-handed (i.e. he/she is by him/herself with a bleeding patient and must attend to other elements of the ABC's). A temporary tourniquet is considered "temporary" for about an hour, after which it is considered to be a "permanent" or long-term tourniquet. If nothing else, temporary tourniquets allow the EMT to "get a handle" on things and get the patient enroute while providing control for a life-threatening or serious bleed.*

   - *Permanent tourniquets can be applied as such or evolve from extended use (beyond 1 hour) of a tourniquet intended at first to be temporary. Permanent tourniquets are used when life-threatening/serious bleeding from an extremity cannot be controlled by any other method. The time of tourniquet application should be documented and relayed to the ED, and care should be taken to use a tourniquet that will not in itself promote more damage (i.e. string, wire, etc.).*

5. Describe the application of a:

   - <u>Pressure bandage</u>*: Once bleeding is essentially controlled by one of the methods described above. A dressing should be placed over the wound and firmly secured with roller gauze.*
   - <u>Temporary tourniquet</u>*: Select the appropriate material (BP cuff ideal for upper extremity), tighten only until bleeding stops.*
   - <u>Permanent tourniquet</u>*: Select appropriate material, fasten around limb, tighten only until bleeding stops. Document time and placement of tourniquet.*

6. Briefly describe each of the following types of soft tissue injuries:

- ***Abrasion****: A scrape that usually involves capillary bleeding.*

- ***Contusion****: A bruise that indicates subcutaneous bleeding in the soft tissue. Contusions may reflect significant internal blood loss.*
  - *2 terms associated with contusions are:*
  - ***Hematoma*** *– a collection of blood trapped in the tissues*
  - ***Ecchymosis*** *– bluish discoloration of an area of skin caused by the accumulation of blood into the subcutaneous tissues.*

- ***Laceration****: A cut through the skin (may be shallow or deep) that has torn, ragged edges.*

- ***Incision****: Also a laceration, but one that has smooth edges, like those made by a scalpel or knife.*

- ***Puncture****: A hole, as made by an ice pick or nail.*

- ***Avulsion****: A tear through the skin and soft tissue resulting in a flap that is either completely separated or partially attached.*

- ***Evisceration****: A laceration through the abdominal wall that results in abdominal contents/organs protruding through the laceration.*

- ***Amputation****: Is the complete separation of bone and soft tissue.*

7. Briefly describe the treatment for each of the following types of injuries:

- *Abrasion: In the absence of other priorities, remove gross debris and cover with sterile dressing, controlling any bleeding. Advise patient of possible need for tetanus booster.*
- *Contusion: Note severity and location of contusion. Consider ice pack on extremity.*
- *Laceration/Incision: In the absence of other priorities, remove gross debris and cover with sterile dressing, controlling any bleeding. Advise pt. of possible need for tetanus booster.*
- *Puncture: Cover with sterile dressing, are difficult to clean, need for tetanus?*
- *Avulsion: In the absence of other priorities, remove gross debris, fold flap back into anatomical position and dress with sterile dressing.*
- *Evisceration: Rapid transport, treat for shock, cover with sterile moist trauma dressing covered by an occlusive dressing to prevent heat loss.*
- *Amputation: Treatment consists of stopping the bleeding from the stump. The most common approach is the use of a pressure dressing. The amputated part needs to be wrapped in a sterile dressing – placed into water proof plastic bag*

Amputation Cont'd:

– *and placed on a bed of ice or ice water slurry to keep the amputated part cool until it can be transported to the hospital.*

8. Identify three(3) types of amputations:

   - *Guillotine, Degloving, Crushing*

9. Briefly describe the clotting process:

   - *Vessels at wound edge initially constrict and bleeding slows. Injured vessels seal themselves by forming a clot, which is caused by blood components which are activated when blood leaves its normal environment of arteries, veins and capillaries. This clotting process is usually complete within 15 minutes or so.*

10. Explain the relationship of the clotting process to the correct method of dealing with blood soaked dressings:

    - *When a dressing being used to hold direct pressure becomes blood-soaked, it is time to replace the dressing. Rather than continuing to add more and more layers of dressing material (which ultimately defeats the purpose of "direct pressure", since direct pressure is now being applied to a wad of dressings, rather than the bleed itself), all but the very first layer of dressing material should be removed and replaced with a clean, dry dressing. Care should be taken to avoid disturbing the bottom most layer of dressing because peeling this off could disrupt the clot that may be forming.*

MAST Pants (PASG)

1. List three (3) benefits/uses of MAST:

   - *May control bleeding.*
   - *May stabilize fractures.*
   - *May temporarily stabilize BP.*

2. Briefly describe the correct procedure to size MAST to a patient:

   - *Pants should be pulled up to fit snugly in crotch area.*
   - *Pants should not extend beyond ankles – or should be cuffed.*
   - *Pants should not extend above rib margin – or should be rolled down.*

3. List the two (2) necessary SxS that ***should*** be present before MAST can be inflated on a patient:

   - *Patient has an evident or suspected active bleed below the level of MAST*
   - *Patient shows SxS of shock*

4. Briefly describe the correct inflation procedure of MAST:

   - *Velcro on pants secured, valves opened, pants inflated with pump or orally to a pressure of 90 mmHg or until the Velcro begins to "crackle". All three compartments may be inflated simultaneously or legs first, followed by the abdomen.*

5. Describe the relationship between transport time and the inflation of MAST:

   - *It is recommended in some areas that pants not be used/inflated for transport times less than 30 minutes. Local protocol will prevail, and if MAST is being used to stabilize a fracture, transport time may be irrelevant.*

6. Describe the relationship in altitude changes and changes within the pressure of the MAST. When would this information be important?

   - *As altitude increases, pressure in the MAST increases.*
   - *As altitude decreases, pressure in the MAST decreases.*
   - *Important to know in the event of aeromedical transport.*

7. Describe the relationship in temperature changes and changes within the pressure of the MAST:

   - *As temperature increases, pressure in the MAST increases.*
   - *As temperature decreases, pressure in the MAST decreases.*

8. In each of the following conditions, describe the circumstance under which you would or would not use MAST:

   - ***There are NO absolute contraindications to MAST – except perhaps on isolated head injury with SxS of increasing ICP or a patient with CHF. However, there are some situations where MAST will not be of any significant value, and should <u>only</u> be inflated with the concurrence of medical control.***

   - *<u>Pregnancy</u>: It is not recommended that the abdominal compartment be inflated on women in advanced pregnancy. The concern is that an amniotic embolus may result. However, it has been shown that inflation of the legs alone for a patient in shock is of very little value. If patient is crashing, inflate legs first, then abdomen, if absolutely necessary. MAST may be useful to*

control vaginal bleeds in early pregnancy (i.e. as caused by a ruptured ectopic pregnancy).

- *<u>Penetrating Object</u>: In <u>NO</u> cases should MAST be inflated <u>over</u> a penetrating object. However, if the patient is crashing, medical control may advise removal of the object and rapid inflation of the MAST.*
- *<u>CPR</u>: CPR in conjunction with MAST inflation is not contraindicated.*

- *<u>Anaphylactic shock</u>: Inflation of MAST on a patient in anaphylaxis may assist in managing peripheral vasodilation.*

HEAD TRAUMA

1. Review the anatomy and physiology of the following components of the central nervous system:

   - *Cerebrum: The largest part of the brain where higher mental functions take place. These include sensation interpretation & coordination of response. Ex: vision, hearing, smell, memory, personality, movement, learning, etc.*

   - *Cerebellum: The small lobular area at the posterior of the brain, inferior to the cerebrum. Its main functions are equilibrium and coordination of muscle groups.*

   - *Brainstem: The stalk-like swelling at the base of the brain that leads into the spinal cord. Within the brainstem are the control centers for vital functions including heart rate, respirations, BP, vomiting, etc. The brainstem is made up of the: midbrain, pons, and medulla oblongata. Located above the brainstem is the thalamus and hypothalamus.*

   - *Spinal Cord: Continuous with the brainstem, the spinal cord carries sensory information back to the brain and conveys motor messages out to the muscles.*

   - *Meninges: Composed of the Dura Mater, the Arachnoid, and the Pia Mater. The three layers of the meninges cover and protect both the brain and the spinal cord.*

   - *Cerebrospinal Fluid (CSF): Continuously produced and reabsorbed by the brain, this fluid serves to cushion the brain and carries glucose and other nutrients.*

2. List the single most reliable vital sign for indicating the presence of a deteriorating head injury:

   - *Any change in the level of consciousness from alert and oriented to person, place, time and event should be considered a key indicator of significant CNS trauma in the presence of a significant mechanism.*

3. Explain how each of the following is assessed in a conscious patient in the field. Include normal and abnormal findings and their significance:

   - ***Level of Consciousness**: Evaluated by continued use of the AVPU scale. Normal is alert and oriented to PPT&E. Abnormal is any decrease of this status. Furthermore, repetitive questioning or evidence of amnesia in an otherwise oriented patient may indicate concussion.*

   - ***Sensory function**: Evaluated by asking if the patient can feel. Normal response is equal and full sensation bilaterally. Abnormal or absent sensation can indicate head or spinal injury. One-sided decrease is indicative of a head injury or nerve root injury; an equal bilateral decrease is indicative of spinal injury.*

   - ***Motor function**: Evaluated by asking the patient to push feet against your hands and squeeze your hands. Normal response is strong and equal strength. Abnormal response includes no response or decreasing response on one or both sides. One-sided weakness indicates an injury or stroke above the cord, while bilateral weakness or paralysis indicates a spinal cord injury.*

4. Explain how each of the following is assessed on an unconscious patient who responds only to pain. Include normal and abnormal findings and their significance:

   - *Level of Consciousness: Check for response to pain. Observe for pain posturing (extension of arms and legs, or flexion of arms with extension of legs).*
   - *Sensory function: Check for response to pain on both arms/legs. If there is a reaction, you can assume sensation. Response is checked bilaterally and at different levels to assess for head/spine injury.*
   - *Motor function: Check for movement of arms/legs, usually by creating pain in extremities by rubbing or pinching. Again, response is checked bilaterally and at different levels to assess for head/spine injury.*
   - *Pupil equality/reactivity: A widely dilated pupil on one side may be a sign of an intracranial bleed.*

5. Describe the signs and symptoms of increasing intracranial pressure, otherwise known as Cushing's Response. Include the physiological reason for each of these changes:

   - *SxS of increasing ICP include an <u>increasing BP</u> as a cardiovascular response to decreased oxygenation of the brain. <u>Heart rate decreases</u> as the body attempts to balance the increase in BP. <u>Respiratory pattern changes</u> (Cheyne-Stokes) are a result of increasing pressure on the respiratory center in the brainstem.*

6. Describe the pathophysiology, life threats, and field management for a patient with a head injury with increasing ICP:

   - ***Pathophysiology**: The increasing pressure may be from either a bleeding vessel in the cranium or swelling from brain tissue injury. Both of these create an increase in the amount of "stuff" in the cranium, raising the pressure. This decreases the amount of blood flow to the brain. Different areas of the brain may not function correctly either from direct damage or from the pressure.*

   - ***Prehospital Life Threats**: Damage or pressure on the respiratory center leading to hypoxia and/or apnea.*

   - ***EMT-B management**: Proper ventilation (12-16 breaths per minute for an adult with adequate tidal volume) with high flow oxygen, MLA ASAP if unconscious and no gag reflex. If patient is exhibiting SxS of ICP (posturing, pupillary changes, etc.), then ventilate at 16-20 breaths per minute.*

7. Briefly explain why high flow oxygen is thought to be effective and beneficial in patients with cerebral edema and increased intracranial pressure:

   - *The brain of a head-injured patient is hypoxic due to cerebral edema and ineffective respirations. High flow oxygen is important in reducing the effects of hypoxia and also acts as a vasoconstrictor to counteract the vasodilating effects of carbon dioxide.*

8. Describe the role of carbon dioxide in cerebral edema:

   - *Carbon dioxide is a potent vasodilator. Patients with respiratory pattern changes may be unable to effectively blow off CO_2. Increased levels of CO_2 result in increased vasodilation, which in turn increases cerebral edema and intracranial pressure.*

9. Compare the following signs and symptoms as they appear in a patient with hypovolemic shock and in an unconscious patient suffering from a head injury resulting in increasing intracranial pressure (ICP):

	Hypovolemia	*Head Injury*
LOC	*decreased*	*decreased*
Pulse	*increased*	*decreased*
BP	*decreased*	*increased*
Respirations	*increased*	*increased/irregular*
Skin Color/Temp.	*pale, cool, diaphoretic*	*pink, warm, dry*

10. Define the following terms and list the underlying cause and signs and symptoms of each:

- ***Linear skull fracture****: Hairline fracture of skull wall. Often without underlying injury to the brain. Impossible to detect without x-ray, or careful digital examination if accompanied by deep scalp laceration. Digital examinations should NEVER be attempted in the field.*

- ***Depressed skull fracture****: Skull fracture accompanied by actual concavity in skull caused by direct blow. Usually accompanied by underlying injury to the brain due to bony fragments being driven into the cerebrum.*

- ***Basilar skull fracture****: Linear skull fracture along the base of the skull and/or skull floor. May be accompanied by raccoon's eyes or Battle's sign.*

- ***NOTE** These are <u>late</u> signs not usually seen in the prehospital setting. CSF may leak from the ears or nose. Sometimes there is bleeding from the ears.*

- ***Concussion****: "Shaking up" of the brain – usually resulting from a fall or direct blow, which may cause a bruise to the brain. Concussions are defined by the fact that there is no permanent underlying brain injury. SxS include a temporary loss of consciousness, usually no longer than 5 min. Other signs may include amnesia of events leading up to the accident as well as the inability to remember new information (retrograde and anterograde amnesia).*

- ***Contusion***: *Bruising and swelling of the brain tissue.*

- ***Epidural Hematoma****: A bleed resulting from tearing of the meningeal arteries between the skull wall and the dura mater. SxS include decreased LOC, increasing ICP. A <u>lucid interval</u> may occur in which an initial loss of consciousness is followed by a brief period of consciousness followed again by unconsciousness.*

- ***Subdural Hematoma:*** *A bleed resulting from damage to the meningeal veins in the arachnoid space beneath the dura. SxS include decreased LOC and increased ICP. Subdural hematomas are classified into 3 types:*
  - *Acute – SxS begin almost immediately after the injury.*
  - *Subacute – SxS begin 3 – 7 days after the injury.*
  - *Chronic – SxS begin 2 to 3 weeks after the injury.*

- *SxS may include persistent headache, nausea, vomiting, personality changes, increasing sleepiness, etc. Chronic subdurals are often seen in alcoholics who have fallen repeatedly.*

11. Briefly outline the field management of a patient with signs of a deteriorating head injury and a significant mechanism for C-spine injury:

    - *Rapid transport with manual stabilization of patient on long spineboard while on scene (strapping and head taping may take place enroute). Secure airway with OPA or NPA as appropriate. Have suction ready. Hyperventilate with BVM and 100% oxygen.*

12. Describe a situation when spinal precautions would NOT be indicated for a patient with a head injury:

    - *Close range gunshot wound to head.*

13. List three (3) types of damage to a motor vehicle that would cause you to suspect the possibility of head trauma:

    - *Starred and bloody windshield.*
    - *Crumpled, depressed roof of car.*
    - *Starred or shattered side windows (lateral impact).*

FACIAL TRAUMA

1. Identify on a diagram the major structures of the eye and briefly describe the function of each:

- Sclera	*White of eye, maintains shape*
- Iris	*Colored portion muscle controlling pupil diameter*
- Pupil	*Opening that allows light to lens*
- Cornea	*Clear portion of sclera, protects eye*
- Conjunctiva	*Thin protective membrane*
-Lens	*Behind the pupil, focuses light on retina*
- Aqueous humor	*Watery fluid between cornea and lens*
- Vitreous humor	*Gel substance behind lens, maintains shape of eye*
- Retina	*Location of receptor cells that convert image into message to brain.*

2. Describe the field management of an eye that has suffered a traumatic injury:

   - *Dressings to control bleeding, stabilize any impaled objects, protect eyes as much as possible. Cover uninjured eye to minimize eye movement. Remember that in a critically injured patient, neatly bandaging an injured eye is <u>low</u> on the list of priorities!*

3. Describe the proper management of contact lenses in the pre-hospital setting:

   - *Contact lenses should not be removed by pre-hospital personnel other than in the case of chemical burns. In that case the lenses must be removed in order to prevent further burning.*

4. Describe the appropriate field management for an eye that has been exposed to a caustic substance:

   - *Irrigate eye with normal saline or water for <u>at least 20 minutes</u>. Make sure to tilt head so that runoff does not contaminate unaffected eye. Alkaline substances may require even more prolonged irrigation.*

5. Describe two (2) ways to control a severe nose bleed:

   - *Pinch bridge of nose or nostrils if tolerated.*
   - *Ice pack to bridge of nose.*

6. List the life threat associated with profuse bleeding in the patient's mouth:

   - *Airway obstruction and aspiration.*

7. Describe the proper method to control severe bleeding in the oral cavity:

   - *Direct pressure applied both externally and internally. Suction as necessary. Do NOT leave or pack dressing material in the mouth.*

8. List three (3) potential life threats associated with injuries to the throat:

   - *Crushed larynx (traumatic airway obstruction).*
   - *Hypovolemia (laceration of carotid arteries, jugular veins).*
   - *Swelling occluding airway*
   - *C-spine injury*
   - *Ruptured esophagus*

SPINE

1. List 4 mechanisms of injury that can result in injury to the spine:

   - *Falls, shallow water diving, MVC's.*
   - *Specific mechanisms are axial loading, excessive flexion or hyperextension, hyper-rotation, sudden or excessive lateral bending, and distraction (over-elongation).*

2. List 8 SxS of spinal injury:

   - *Significant mechanism of injury*
   - *Deformity*
   - *Guarding or self-splinting of neck/back*
   - *SxS of neurogenic shock*
   - *Pain on palpation of neck/back*
   - *Paralysis/paresis*
   - *Numbness/tingling in extremities*
   - *Priapism in males*

3. Describe how you would assess a patient for spinal injury:

   - *Ask patient about numbness/tingling*
   - *Evaluate mechanism of injury*
   - *Palpate C-spine/back*
   - *Distal neurovascular checks*

4. Describe the field management of a stable, non-critical patient who exhibits signs and symptoms of spinal injury:

   - *Manually stabilize C-spine during initial assessment. If patient is conscious, instruct him/her not to move. When ready to move patient to ambulance, use sufficient personnel to log roll or straddle slide patient on to long spineboard. Adjust positioning if necessary by sliding patient up and down vertically until patient is centered on the board ("Z-drag"). Place padding in appropriate areas, and secure body with straps, making sure to secure straps across large bony structures of body (i.e. pelvis) and avoiding areas such as abdomen, knees, etc. Then secure head using headblock or blanket roll and tape. Studies suggest that a C-collar, blanket roll and spineboard are <u>all</u> necessary for best immobilization. However, if a properly fitting C-collar is not available, it is better to go without than to apply an ill-fitting one. An alternative to the traditional long spineboard, the vacuum splint long spineboard is currently in use by many services. This device eliminates the need for padding, is more comfortable, and seems to do a better job of providing comfort during immobilization and transportation.*

5. How would the management described above change if the patient exhibiting signs and symptoms of spinal injury is a <u>critically injured unstable</u> trauma patient:

   - *Patient would be rapidly placed on spineboard as described above, but manually stabilized on board until loaded. Full strapping and completion of immobilization can take place enroute.*

6. Indicate three (3) areas on adults and on pediatric patients that commonly require padding when applying a spineboard:

   - *Adult: back of head, small of back, beneath knees.*
   - *Peds: beneath shoulders (to maintain appropriate head position), around body, between legs.*

7. Briefly explain the technique of "rapid extrication" and when it is appropriate:

   - *Rapid extrication refers to the rapid removal of a critically injured patient from a motor vehicle. These patients meet the criteria for spinal immobilization, but due to the critical nature of their injuries, the time spent carefully packaging and extricating these patients with a KED would be inappropriate and harmful to the patient. In rapid extrication a minimum of 2-3 people manually stabilize the patient in the vehicle and carefully rotate the patient and lower him/her on to a long spineboard that is placed on the edge of the seat. The patient is then loaded and strapping and completion of immobilization takes place enroute.*

8. Describe the technique used to deal with a vomiting patient who is completely immobilized on a long spineboard:

   - *Tilt the entire board to the side to facilitate drainage. Suction!*

9. Establish the relationship between airway management and the trauma patient:

   - *Critical patients: The guiding principle for airway management in the critical trauma patient is that the value of the intervention needs to be weighed with the value of rapid transport. Interventions at the scene include clearing the airway (both of foreign objects and emesis/blood) and ventilating the apneic or hypopneic patient. As a general rule, ventilate with a BVM anyone whose respirations are 8 or below. However, if a critical trauma patient is breathing at all and can be in the rig within a minute or two, it's probably best to wait until in the rig to use the BVM. If the patient is apneic or if loading is delayed, bag the patient at the scene. It is recommended that the OPA/NPA, oxygen and MLA be delayed in the critical trauma patient until enroute unless there are extenuating circumstances.*

   - *Noncritical patients: Full, appropriate management of the airway and respiratory status of the noncritical patient may be done at the scene, since rapid transport is not an issue.*