TO: ALL LUCAS COUNTY PARAMEDICS

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Lucas County EMS Continuing Education Program Administrator

DATE: December 1, 2009

SUBJECT: **Continuing Education – January 2010**

In the month of October we will review critical trauma assessment and treatment skills. The bulk of the four-hour training session will be dedicated to mock scenarios and "hands-on" practice. I ask that you review the LCEMS protocols related to:

- Trauma Assessment / Scene Survey
  - Rapid trauma examination
  - Primary / Secondary Exam
- Kendrick Extrication Device (KED)
- Traction Splinting (Hare / Sager)
- Chest trauma assessment / treatment
- Head trauma assessment / treatment
- Abdominal trauma assessment / treatment

Additionally, I have expanded the scope of the ResQGARD protocol to include trauma presentations. I have included a revised ResQGARD protocol for you to review.

The attached pre-test will help better prepare you for the topics and skills to be covered during the month of January. Answers have been provided for your own self-assessment. There will be a short review period at the beginning of class.

I look forward to seeing you in the coming month. If you have any questions or comments please feel free to contact me thru e-mail or by phone

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Trauma Pre-Test

1. Serious and life-threatening injuries occur in ___% of trauma patients.
    a. <10
    b. 15-25
    c. 30-40
    d. >50

2. During your scene assessment, you learn that the driver wore a lap belt only. Based upon this information, what types of injuries would you expect?
    a. Head and neck
    b. Chest
    c. Intra-abdominal or lower spine
    d. Pelvic and femur fractures

3. Which of the following statements is true regarding lateral impact accidents?
    a. A greater amount of passenger protection lessens the injury pattern
    b. These accidents account for the smallest percentage of vehicular deaths
    c. The amount of vehicular damage exaggerates the injury pattern
    d. None of the above

4. The most commonly seen injury associated with rear-impact accidents is:
    a. Kidney laceration
    b. Lumbar spine fracture
    c. Cervical spine injuries
    d. Cardiac contusion

5. When assessing falls, you should focus your attention on:
    a. The height of the fall
    b. The surface the victim fell onto
    c. The body part that hit first
    d. All of the above

6. Which of the following impaled objects should be removed?
    a. Lodged in the cheek, causing airway obstruction
    b. Lodged in the trachea, causing airway obstruction
    c. Lodged in such a way as to prevent CPR
    d. All of the above

7. Which of the following statements is true regarding a bullet's entrance wound?
    a. It matches the size of the bullet's profile
    b. It will often have a "blown out" appearance
    c. If the bullet is fired at close range, subcutaneous emphysema will be present
    d. It accurately portrays the potential for damage

8. Your patient has attempted suicide by slitting his wrists. You notice that he has run the knife across his wrist, perpendicular to the arm, and that the wound is rather deep. Which of the following statements is true regarding the likelihood for serious blood loss?
    a. You should expect severe blood loss
    b. There is most likely tremendous internal blood loss
    c. Blood loss is probably not life-threatening
    d. A tourniquet will probably be necessary

9. Your patient presents with profound hypotension from external and internal hemorrhage. How much blood do you estimate he has already lost?
    a. <15%
    b. 15-25%
    c. 25-35%
    d. >35%

10. Tachycardia; cool, clammy, and pale skin; and a stable blood pressure describe a patient in:
    a. Compensated shock
    b. Decompensated shock
    c. Irreversible shock
    d. None of the above

11. Which of the following statements is true regarding the management of musculoskeletal injuries?
    a. Always splint the joints above and below the fracture site
    b. Always splint the bones above and below a dislocated joint
    c. Always perform distal neurovascular tests before and after any splinting
    d. All of the above

12. Traction splinting is indicated in which of the following conditions?
    a. Isolated midshaft femur fracture
    b. Disease-induced proximal femur fracture
    c. Bilateral femur fractures with profound shock
    d. All of the above

13. Which of the following statements is true regarding scalp lacerations?
    a. They tend to bleed profusely
    b. They result in severe bleeding that can lead to shock
    c. The blood vessels lack effective muscular control
    d. All of the above

14. Battle's sign and periorbital ecchymosis are classic signs of a/an:
    a. Intracerebral hemorrhage
    b. Basilar skull fracture
    c. Depressed skull fracture
    d. Subdural hematoma

Questions 15-20 refer to the following scenario:

Your patient is a 25-year-old MMA fighter who was knocked out with a left hook to the side of the head and now lies in the dressing room fully awake. His initial vital signs are BP 130/80, pulse 80, respirations 18, and pupils equal and reactive to light. En route to the hospital, he begins to lose consciousness and complains of being sleepy. His breathing becomes erratic, his pulse slows to 60, and his blood pressure rises to 180/90. His left pupil is larger than the right and is slow to react to light.

15. This patient is probably suffering from a/an:
    a. Epidural hematoma
    b. Subdural hematoma
    c. Basilar skull fracture
    d. Concussion

16. The rapid onset of signs and symptoms is most likely due to:
    a. Fracture of the cribiform plate
    b. Rupture of the middle meningeal artery
    c. Leakage of CSF into soft tissues
    d. Jarring of the reticular activating system

17. This patient also shows the classic signs and symptoms of:
    a. Increasing intracranial pressure
    b. Decreasing cerebral blood volume
    c. Basilar skull fracture
    d. Contrecoup injury

18. These signs and symptoms are caused by:
    a. Brain shrinkage
    b. Cerebral blood flow interruption
    c. Brainstem herniation
    d. Abnormally low carbon dioxide levels

19. This patient may hyperventilate in an attempt to:
    a. Vasodilate the brain vasculature
    b. Vasoconstrict the brain vasculature
    c. Increase carbon dioxide levels
    d. Cause a metabolic alkalosis

20. This patient may vomit without accompanying nausea due to:
    a. High levels of carbon dioxide
    b. Brain hypoxia
    c. Cushing's reflex
    d. Pressure on the medulla

21. Which mechanism of injury causes the majority of spinal cord injuries?
    a. Penetrating trauma
    b. Sports-related trauma
    c. Falls
    d. Motor vehicle crashes

22. Approximately how many spinal cord injuries result from improper handling after the incident?
    a. 5%
    b. 25%
    c. 50%
    d. 75%

Questions 23-26 refer to the following scenario:

Your patient is a 45-year-old male who was ejected from a vehicle accident in a one-car rollover accident. He presents on the ground complaining of the inability to move his arms and legs. His airway is clear, and his vital signs are respirations 18 with no chest rise, BP 70/30, pulse 50, and skin warm and dry. He also presents with priapism and the hands in the "hold-up" position.

23. Your field diagnosis of this patient should include:
    a. Neurogenic shock
    b. Cervical spinal cord interruption
    c. Bilateral paralysis
    d. All of the above

24. His unusual vital sign presentation is due to:
    a. Peripheral nerve interruption
    b. Loss of sympathetic nervous system control
    c. Loss of parasympathetic nervous system control
    d. Blood loss below the injury

25. The priapism is caused by:
    a. Parasympathetic stimulation
    b. Sympathetic stimulation
    c. Total autonomic nervous system dysfunction
    d. None of the above

26. The absence of chest rise is due to:
    a. Intercostal muscle paralysis
    b. Rupture of the diaphragm
    c. Damage to the third cranial nerve
    d. Cushing's reflex

Questions 27-29 refer to the following scenario:

Your patient is a 26-year-old who was shot with a small-caliber handgun in the right chest. She presents with dyspnea, distended neck veins, absent breath sounds on the right side, diminished breath sounds on the left side, hyperresonance on both sides, and tracheal deviation toward the left side. Her vital signs are BP 70/30, pulse 120 and weak, and respirations 30 and shallow.

27. Your field diagnosis is:
    a. Simple pneumothorax
    b. Tension pneumothorax
    c. Pericardial tamponade
    d. Massive hemothorax

28. Her hypotension could be caused by:
    a. Decreased venous return
    b. Tamponade effect on the heart
    c. Blood loss
    d. All of the above

29. Emergency field management of this patient includes:
    a. Pneumatic antishock garment
    b. Needle chest decompression
    c. Pericardiocentesis
    d. None of the above

Questions 30-31 refer to the following scenario:

Your patient is a 67-year-old female who was struck by a car and lies on the ground. She presents with dyspnea, pain to the right chest, dull percussion on the right side, and diminished breath sounds on the right side. Her vital signs are BP 80/60, pulse 110, respirations 30, skin cool and clammy, and flat neck veins.

30. Your field diagnosis is:
    a. Tension pneumothorax
    b. Hemothorax
    c. Pericardial tamponade
    d. Traumatic asphyxia

31. Emergency field management of this patient includes:
    a. Rapid IV fluid replacement
    b. Pericardiocentesis
    c. Needle decompression
    d. Pneumatic antishock garment

Questions 32-34 refer to the following scenario:

Your patient is a 35-year-old unbelted male driver who hit the steering wheel and windshield in a one-car accident. He presents unconscious with the following vital signs: BP 110/90, pulse 120 and weak, respirations 28 and shallow, lung sounds equal and clear, distant heart sounds, skin cool and clammy and distended neck veins. His only external sign of trauma is a midsternal bruise.

32. Your field diagnosis is:
    a. Tension pneumothorax
    b. Massive hemothorax
    c. Traumatic asphyxia
    d. Pericardial tamponade

33. This patient's primary problem is:
    a. Air filling the pleural space
    b. Fluid in the pericardial sac
    c. Severe crushing injury to the chest
    d. Blood in the pleural space

34. Emergency management of this patient includes:
    a. Needle decompression
    b. Chest tube
    c. Pneumatic antishock garment
    d. Pericardiocentesis

35. Rebound tenderness is a classic sign that suggests:
    a. Diaphragmatic tear
    b. Hypovolemic shock
    c. Peritoneal irritation
    d. Aortic aneurysm

36. Abdominal guarding usually indicates:
    a. Diaphragmatic tear
    b. Hypovolemic shock
    c. Peritoneal irritation
    d. Aortic aneurysm

37. Which of the following conditions may occur during pregnancy if the mother sustains blunt trauma to the abdomen?
    a. Abruptio placenta
    b. Placenta previa
    c. Ruptured ectopic pregnancy
    d. Pregnancy-induced hypotension

Questions 38-43 refer to the following scenario:

You are awakened in the middle of the night for a call on a quiet country road. Your patient was the unrestrained driver in a one-car high-speed auto accident involving frontal impact with a telephone pole. He is a 19-year-old male who presents unconscious and partially trapped in the severely deformed vehicle. According to witnesses, he was driving at a high rate of speed. Upon initial examination, you immediately hear gurgling respirations. Vital signs are: weak carotid pulse of 120; BP 70/40; respirations 36 and shallow; skin cool, pale, and clammy; and capillary refill time 4 seconds. Pulse oximetry reads 70%. Upon physical exam, you discover a bruise to the front chest wall with a loose flail segment and some abdominal guarding. Lung sounds are diminished on the right side with some hyperresonance in that area.

38. Your initial management of this patient should be to:
    a. Perform immediate nasotracheal intubation
    b. Start two large-bore IVs
    c. Manually stabilize his head and neck
    d. Place an oxygen mask on him

39. The gurgling noise that accompanies his breathing calls for immediate:
    a. Suctioning
    b. Intubation
    c. Head-tilt/chin-lift procedure
    d. Chest decompression

40. You are concerned about the right-sided flail segment because:
    a. It indicates lung tissue damage beneath the injury
    b. It severely inhibits ventilation and oxygenation
    c. It is usually accompanied by pericardial tamponade
    d. Underlying damage to the heart is expected

41. His respiratory situation indicates the need for immediate:
    a. Chest decompression
    b. Trendelenburg positioning
    c. Intubation
    d. Positive pressure ventilation

42. Your patient's pulse and blood pressure indicate which stage of shock?
    a. Compensated
    b. Irreversible
    c. Decompensated
    d. None of the above

43. The most likely cause of your patient's shock is:
    a. Loss of alveolar function
    b. Internal blood loss
    c. Massive vasodilation
    d. Acute myocardial infarction

Answers & Rationales

1. **A.** Serious and life-threatening injuries occur in fewer than 10% of trauma patients. That's the good news. The bad news is that prehospital care providers can do little to stabilize these patients because they involve major head injury or body cavity hemorrhage. In these cases, the best care includes rapid transport to a trauma center.

2. **C.** When the lap belt is worn without the shoulder straps, the victim suffers a sudden folding of the body at the waist, resulting in intra-abdominal and lower spine injuries.

3. **D.** Lateral impacts account for 15% of all auto accidents, yet they are responsible for 22% of vehicular fatalities. The amount of structural steel between the impact side and the vehicle interior is greatly reduced. When a lateral impact occurs, the index of suspicion for serious internal injuries should be higher than vehicle damage alone suggests.

4. **C.** In rear-end impact; the collision force pushes the auto forward, while the vehicle seat propels the occupant forward. If the headrest is not up, the head is unsupported and remains stationary. The neck extends severely, while the head rotates backwards. Cervical spine injuries are common with rear-end collisions.

5. **D.** When assessing the mechanism of injury of falls, you should evaluate the following aspects: the height of the fall, the landing surface, and the part of the body that impacted first.

6. **D.** In general, you want to immobilize an impaled object to prevent further injury, except in the following cases: an object lodged in the cheek or trachea, causing an airway obstruction, or one preventing you from performing CPR.

7. **A.** Entrance wounds are generally the size of the bullet's profile and quickly close due to the skin's natural elasticity.

8. **C.** A clean, lateral cut of a blood vessel allows the vessel to retract and thicken its wall. This reduces the lumen, reduces blood flow, and assists in the clotting mechanism. In this type of case, blood loss usually will not be life-threatening. A longitudinal cut is an entirely different matter.

9. **D.** At greater than 35% blood loss, a person will present with profound hypotension because he has lost the massive vasoconstriction that helped maintain the blood pressure. As the precapillary sphincters reopened, the blood pressure dropped. This marks the beginning of decompensated shock.

10. **A.** Following the onset of inadequate tissue perfusion, various compensatory mechanisms of the body are stimulated. The heart rate and strength of cardiac contractions increase. There will be an increase in systemic vascular resistance to assist in maintaining the blood pressure. These compensatory changes will continue until the body is unable to maintain blood pressure and tissue perfusion. Your patient in compensatory shock will exhibit tachycardia, cool, clammy, and pale skin with a stable blood pressure.

11. **D.** Always splint the joints above and below the fracture site and the bones above and below a dislocated joint. Before and after any splinting, always perform distal neurovascular checks for circulation, sensory, and motor function.

12. **A.** The traction splint is the best device to splint the hemodynamically stable patient with an isolated femur fracture.

13. **D.** The scalp is an area frequently subjected to soft tissue injury. Because this area is extremely vascular and because the scalp vessels are larger and not quite as muscular as other vessels, blood loss can be rapid and difficult to control. Severe and persistent bleeding from scalp lacerations can contribute to shock.

14. **B.** Battle's sign is a black-and-blue discoloration over the mastoid process just behind the ear. Bilateral periorbital ecchymosis is a black-and-blue discoloration of the area surrounding the eyes. Both of these signs are normally associated with a basilar skull fracture.

15. **A.** An epidural hematoma is an accumulation of blood between the dura mater and the cranium.

16. **B.** The rapid onset of signs and symptoms following an epidural hematoma occurs because the bleeding involves arterial vessels, often the middle meningeal artery. The condition progresses rapidly while the patient moves quickly toward unconsciousness. Since the bleeding is arterial, intracranial pressure builds rapidly, compressing the cerebrum and increasing the pressure within the skull.

17. **A.** This patient shows the classic signs and symptoms of increasing intracranial pressure: an altered respiratory pattern, bradycardia, hypertension, unequal pupils, and a decreasing level of consciousness.

18. **C.** These signs and symptoms are caused by brainstem herniation. As the pressure in the cranium increases, the brain is pushed downward through the tentorium toward the brain stem. Because the brain stem houses our cardiac and respiratory centers, these vital signs are affected.

19. **B.** High levels of carbon dioxide cause the brain vasculature to dilate. This results in increased blood volume, which, in turn, increases the pressure within the skull. In an attempt to vasoconstrict these vessels and reverse the process, the body may begin to hyperventilate.

20. **D.** The vomit center is located in the medulla oblongata. Pressure on this center will cause immediate vomiting without accompanying nausea. The vomiting is usually forceful and known as "projectile vomiting."

21. **D.** The majority of spinal cord injuries (48%) are the result of motor vehicle crashes, most commonly in young men ages 16-30.

22. **B.** As many as 25% of all spinal cord injuries result from improper handling of the spinal column (and the patient) after an injury. This is often caused by bystanders.

23. **D.** Your prehospital diagnosis of this patient should include cervical spinal cord interruption, bilateral paralysis, and neurogenic shock.

24. **B.** Patients in shock usually present with hypotension, tachycardia, and cool, clammy skin. These signs indicate that the sympathetic nervous system compensatory mechanism has been activated. Your patient's unusual vital sign presentation (i.e., hypotension, bradycardia, warm and dry skin) indicate the loss of sympathetic nervous system control.

25. **A.** Priapism is a painful penile erection. In this case, it is caused by the loss of sympathetic nervous system tone, allowing parasympathetic stimulation to dominate.

26. **A.** Interruption of the spinal cord in the cervical region will cause the intercostal muscles of the chest to become dysfunctional. Patients with this problem exhibit "belly breathing" characterized by movement of the diaphragm.

27. **B.** This patient who presents with absent lung sounds on one side and decreased sounds on the other, with hyperresonance, jugular venous distention, and a deviated trachea, has a tension pneumothorax.

28. **D.** Her hypotension could be the result of a combination of factors. The high intrathoracic pressures caused by the injury may decrease venous return. The tension could produce a tamponade effect on the heart, severely decreasing cardiac output. She may have blood loss from bleeding within the chest or other injuries.

29. **B.** Emergency management of this patient includes immediate and rapid evacuation of the air trapped in the pleural space. Needle decompression is done by placing a large-bore IV catheter into the chest at the second intercostal space, midclavicular line. Then relieve any built up trapped air with the use of a syringe.

30. **B.** This patient's presentation of dyspnea, pain to the right chest, diminished breath sounds on the right side, dull to percussion on the right side, and shock indicates hemothorax. A hemothorax is caused by bleeding into the pleural space.

31. **A.** Emergency field management of this patient includes treating for shock by replacing blood fluid volume rapidly.

32. **D.** This patient's presentation of distant heart sounds, distended neck veins, and a narrow pulse pressure indicates pericardial tamponade. This is the classic Beck's triad.

33. **B.** Pericardial tamponade is the filling of the pericardial sac with fluid, which, in turn, limits the filling of the heart.

34. **D.** Definitive emergency management of this patient includes Pericardiocentesis. This procedure involves the insertion of a large-bore spinal needle into the pericardial sac and aspirating the excess blood. This procedure has many complications and is seldom performed by paramedics in the field. This patient requires immediate transport

35. **C.** Rebound tenderness is pain upon the release of your hand during deep palpation, allowing the patient's abdominal wall to return to its normal position. It is a classic sign of peritoneal irritation and suggests a bacterial or chemical irritation caused by intra-abdominal bleeding or hollow organ rupture.

36. **C.** The peritoneum can become irritated by the presence of blood. The patient with peritoneal irritation often presents with guarding because it hurts to move.

37. **A.** Blunt trauma to the uterus may cause the placenta to detach from the uterine wall. This condition is known as abruptio placenta and presents a life-threatening risk to both the mother and the baby.

38. **C.** Always stabilize a cervical spine if the mechanism of injury strongly suggests an injury in this area. Assign one of your crew to stabilize the head manually while you continue your primary assessment. Release manual stabilization only after you secure the head to a long spine board.

39. **A.** Always ensure a patent airway immediately. Examine it for fluids, obstruction, or signs of trauma and apply suction as necessary. A noisy airway is an obstructive airway.

40. **B.** Always be concerned about a flail segment because it may severely inhibit ventilation and oxygenation. Your patient may become hypoxic and hypercarbic.

41. **D.** This patient's respiratory situation indicates the need for positive pressure ventilation with a bag-valve-mask and supplemental oxygen.

42. **C.** Your patient's blood pressure and pulse indicate that he is in decompensated shock. It is during this stage that the body's normal defense mechanisms are failing.

43. **B.** The most probable cause of this patient's shock is internal blood loss, probably in the abdomen.

CC
ResQGARD
Impedance Threshold Device

The ResQGARD is an impedance threshold device (ITD) that provides therapeutic resistance to inspiration in spontaneously breathing patients. During inspiration, a negative pressure (created from expansion of the thorax) draws air into the lungs. When inspiratory impedance is added to the ventilation circuit, it enhances the negative pressure (vacuum) in the chest, which pulls more blood back to the heart, resulting in increased preload and thus, enhanced cardiac output on the subsequent cardiac contraction. The ResQGARD provides therapeutic benefit as soon as it is placed into the circuit and may be helpful in establishing intravenous access.

Clinical Indications:

- Spontaneously breathing patients ≥ 25 lbs. who are experiencing symptoms of low blood circulation or hypotension (< 100 mm Hg [adults]; < 90 mm Hg [children]), which can be secondary to a variety of causes such as:
  - **Hypovolemia**
    - Internal hemorrhage
    - External hemorrhage
    - Dehydration
  - **Trauma-Related Hypovolemia**
    - Abdominal trauma (penetrating /blunt)
    - Extremity trauma (penetrating / blunt)
  - **Hypotension**
    - Dialysis
    - Sepsis
    - Orthostatic intolerance
    - Medication reaction

Contraindications (Absolute):

- Patients < 25 lbs.
- Penetrating / blunt chest trauma
- Patients with flail chest
- Patients with ongoing, known uncontrolled blood loss
- Shortness of breath, respiratory insufficiency
- Chest pain
- Congestive heart failure
- Dilated cardiomyopathy
- Pulmonary hypertension
- Aortic stenosis

CC
ResQGARD
Impedance Threshold Device

Impedance Threshold Device (ResQGARD), continued

Contraindications (Relative):

- Blood loss of unknown rate
  - In the situation where life-threatening bleeding is not under control, the ResQGARD may accelerate bleeding. For this reason it is important to have bleeding under control before applying the ResQGARD. In cases where the rate of blood loss is unclear, the recommendation is to use the ResQGARD as you would a fluid challenge in the field (i.e., if a fluid challenge is indicated, then the ResQGARD would be too). If it is believed that the administration of fluids would worsen bleeding and "permissive hypotension" is desired (i.e., maintaining systolic BP at 90), then the ResQGARD should not be used. Since the use of an ITD may be fluid-sparing and can be discontinued immediately, a trial application of the ResQGARD may be considered.

Notes / Precautions:

- The safety and effectiveness in persons suffering from arterial stenosis or asthma has not been established.
- Prolonged use for more than 30 minutes has not been clinically evaluated.
- If respiratory distress develops during use of the ResQGARD, immediately discontinue use.
- With a patient complaint of nausea and/or vomiting, the ResQGARD should only be used with the mouthpiece or facemask w/o strap to allow for easy removal.

Procedure for Field Application:

A. <u>Using the ResQGARD on a facemask</u>:

1. Identify the need for ResQGARD application (indication for use).

2. Reassure patient; positioning as necessary.

3. Vital signs (evaluate P, RR, and BP).

4. Apply cardiac monitor.
   i. Acquire automated BP prior to ResQGARD use.
      a. If automated BP analysis is not available, acquire manual or palpated BP (monitor BP before, during, and after ResQGARD use).
   ii. Attach pulse oximeter probe for continuous $Sp0_2$ monitoring before, during, and after ResQGARD use.

Impedance Threshold Device (ResQGARD), continued

5. Connect the ResQGARD with $EtC0_2$ filterline to vented facemask provided; make sure all pieces fit together snugly.

6. Explain to the patient that the device will make it slightly more difficult to take a breath but that the resistance is what may make them feel better.

7. Gently (but firmly) hold the ResQGARD over the nose and mouth (or have the patient hold), establishing and maintaining a tight face seal with the facemask. The head strap (e.g., ResQSTRAP) may be used if the patient does not want to hold the ResQGARD in place except in case of nausea and/or vomiting.

8. Attach $EtC0_2$ filterline to LP12 (if available) for continuous capnometric/capnographic analysis.

9. Have patient breathe in slowly (over 2-3 seconds) and deeply; exhale normally. Breathe at a rate of 10-16/minute.

10. If supplemental oxygen is used, attach the tubing to the oxygen port on the ResQGARD and deliver 1-15 liters per minute. Do not exceed 15 lpm.

11. If patient is unable to tolerate mask application (i.e., confinement, anxiety, "smothering" effect), consider attaching the ResQGARD to the mouthpiece provided.

B. <u>Using the ResQGARD with a mouthpiece</u>:
   1. Identify the need for ResQGARD application (indication for use).

   2. Reassure patient; positioning as necessary.

   3. Vital signs (evaluate P, RR, and BP).

   4. Apply cardiac monitor.
      i. Acquire automated BP prior to ResQGARD use.
         a. If automated BP analysis is not available, acquire manual or palpated BP (monitor BP before, during, and after ResQGARD use).
      ii. Attach pulse oximeter probe for continuous $Sp0_2$ monitoring before, during, and after ResQGARD use.

Impedance Threshold Device (ResQGARD), continued

5. Connect the ResQGARD with $EtC0_2$ filterline to the mouthpiece provided; make sure the pieces fit together snugly.

6. Explain to the patient that the device will make it slightly more difficult to take a breath but that the resistance is what may make them feel better.

7. Place the mouthpiece into the patient's mouth and establish and maintain a tight seal with the lips.

8. Attach $EtC0_2$ filterline to LP12 (if available) for continuous capnometric/capnographic analysis.

9. Have patient breathe in slowly (over 2-3 seconds) and deeply **through the mouth only**; exhale normally. Breathe at a rate of 10-16/minute.

10. A nose clip may be helpful if the patient has trouble inspiring only through their mouth.

11. If supplemental oxygen is used, attach the tubing to the oxygen port on the ResQGARD and deliver 1-15 liters per minute. Do not exceed 15 lpm.

Special Patient Considerations:

A. In a patient without intravenous (IV) access, applying the ResQGARD may make it easier to establish an IV because of the improvement in blood pressure. The ResQGARD should be used in conjunction with other indicated treatments for hypotension (e.g., fluids, vasopressors, patient positioning). Once the patient is feeling better and the blood pressure has stabilized and risen to an acceptable level (e.g. > 110 mm Hg in adults), it is recommended that you continue ResQGARD treatment for approximately 10 minutes before discontinuing its use. Frequently assess the patient and vital signs for returning symptoms of hypotension. If the patient begins to decompensate, the ResQGARD should be re-applied.

B. If the ResQGARD has been applied in the field, and transport is indicated, the ResQGARD should be removed from the patient upon transfer to the ED staff. The ResQGARD should not be left in the hands of untrained healthcare providers.

Impedance Threshold Device (ResQGARD), continued

C. In the setting of orthostatic intolerance, ResQGARD use may result in improved blood pressure and patient presentation without the use of cojunctive therapies (i.e., fluid, vasopressors, patient positioning). Once the patient is feeling better and the blood pressure has stabilized and risen to an acceptable level, ResQGARD treatment should continue for approximately 10 minutes before discontinuing its use. Reassess the patient's vital signs frequently (minimum of 3 measurements) after ResQGARD use, including orthostatic measurements of pulse and blood pressure. The orthostatic intolerant patient, who after adequate assessment maintains a stabilized blood pressure and pulse after ResQGARD discontinuation, may not require transport by a life squad. All details of patient assessment/treatment before, during and after ResQGARD use must be included in the patient care report (PCR).

D. Some patients who are claustrophobic will tolerate ResQGARD use on a mouthpiece better than on a facemask.

E. The ResQGARD is single-patient use only.

F. Serial blood pressures every 5 minutes, pulse oximetry, and continued patient assessment are necessary for evaluating ResQGARD effectiveness.