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**EMS SKILL**

BREATHING EMERGENCY / AIRWAY MANAGEMENT

**BAG - MASK - VENTILATION (BMV)**

**UNPROTECTED AIRWAY**

**PERFORMANCE OBJECTIVES**

Demonstrate proficiency in ventilating a simulated patient utilizing a Bag Mask Ventilation (BMV) device.

**CONDITION**

Ventilate a simulated adult, child, or infant in respiratory arrest (with an unprotected airway) for a minimum of one (1) minute using the 1 and 2 rescuer technique. Necessary equipment will be adjacent to the patient or brought to the field setting.

**EQUIPMENT**

Adult, child or infant manikin, adult and pediatric BMV device O2 connecting tubing, oxygen source with flow regulator, oropharyngeal and nasopharyngeal airways appropriate for manikin, silicone spray, water-soluble lubricant, 10cc syringe, pediatric resuscitation tape, suction, goggles, masks, gown, gloves, timing device, airway bag.

**PERFORMANCE CRITERIA**

• Items designated by a diamond (⧫) must be performed successfully to demonstrate skill competency.

• Items identified by double asterisks (\*\*) indicate actions that are required if indicated.

• Items identified by (§) are not skill component items, but should be practiced.

• Ventilation must be at least at the minimum rate required for the situation given.

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| **PREPARATION** | | |
| **Skill Component** | **Key Concepts** | |
| ⧫ Establish body substance isolation precautions | • Mandatory personal protective equipment – gloves at all times  • Situational - goggles, masks, gown as needed | |
| ⧫ Assess breathing for:   * Rate * Depth * Quality * SpO2 – if available | * Signs and symptoms of breathing difficulties include: * Shortness of breath * Wheezing * Inadequate tidal volume * Cyanosis * Tachypnea * Nasal flaring * Position of the patient (tripod) * Altered level of consciousness * Pulse oximetry [measures](http://en.wikipedia.org/wiki/Invasiveness_of_surgical_procedures) the oxygen saturation (SpO2) of the patient’s arterial blood. * Signs and symptoms of hypoxia may include SpO2 readings of less than 94% with respiratory distress, altered mental status, or changes in skin signs. | |
| ⧫ Select the appropriate size mask and bag | • Ideally rescuers should use the appropriate size bag and mask. However, the size of the bag is not as important as the size of the mask.  ***Note:*** *If an adult bag is used on a pediatric patient, the tidal volume*  *delivered should not exceed the pediatric patient’s normal chest rise of normal inspiration.* | |
| ⧫ Assemble the BMV device  **\*\* ALS providers - Place continuous waveform capnography sensor between the bag and mask *- if available*** | • Waveform capnography measures the carbon dioxide (CO2) in a patient’s exhaled breath (immediate graphic depiction of ventilation). It also (indirectly) measures metabolism and circulation.  • End-tidal carbon dioxide (EtCO2) measures the CO2 in an expired breath.  • Since waveform capnography is a measure of ventilation and pulse oximetry is a measure of oxygenation, ALS providers should use both devices to assess the patient’s respiratory status.   * DO NOT delay the initiation of BMV ventilation. * Do not delay ventilating the patient with a   • Do not delay ventilation to place a pulse oximetry device on the  patientpatient’s finger; may be done after ventilations have started. | |
| **Skill Component** | **Key Concepts** | |
| ⧫ Connect BMV device to oxygen source | • Do not delay ventilation to connect the BMV device to an oxygen source; may be done after ventilations have started. | |
| ⧫ Turn oxygen regulator to deliver 15L/minute - *if indicated* |  | |
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| **SINGLE RESCUER BAG-MASK VENTILATION**  **PROCEDURE** | | |
| **Skill Component** | **Key Concepts** | |
| ⧫ Open the airway:  • Medical - head-tilt/chin-lift  • Trauma - jaw-thrust | | • Move the patient no more than necessary to ensure an open airway.  • A 2nd rescuer is needed to maintain in-line axial stabilization if spinal immobilization is required.  *Note: If only one (1) rescuer is available to maintain spinal motion restriction and ventilate with a BMV device, the EMT may use his/her knees to stabilize the head.*  • It is important to maintain a neutral position in pediatric patients to prevent hyper-flexion of the neck which may inhibit ventilations or occlude the airway (head is relatively large for size of the body).   * ***Note: Place approximately two (2’) of padding under the shoulders or entire torso to achieve appropriate airway alignment.*** |
| ⧫ Remove visible obstruction or suction – *if indicated* | |  |
| ⧫ Insert oropharyngeal (OPA) or nasopharyngeal (NPA) airway – if indicated | | • NPAs are contraindicated in infants (less than 12 months) due to the small diameter of the nostril and presence of adenoidal tissue.  • Some NPA airways may extend past the nostrils. This results in inability to maintain a tight seal and inhibits the function of the NPA when the mask is in place. |
| ⧫ Place the mask over the mouth and nose, maintaining a tight seal and patent airway by using the C-E technique  **\*\* *The top of the mask is over the bridge of the nose and the bottom is in the groove between the lower lip and the chin.*** | | • Avoid pushing mask down on the face. Pressure on the eyeballs results in vagal stimulation – especially in pediatric patients.  • Avoid pressure on soft tissue under the chin which may result in airway obstruction. |
| ⧫ Ventilate the patient with the appropriate volume:  • Observe for adequate rise and fall of chest  • Allow for adequate exhalation between ventilations | | • Use only enough force to allow for good chest rise. Over-inflation causes gastric distention which will decrease tidal volume by elevating the diaphragm.  • Exhalation requires more time than inspiration.  • The bag is refilled with oxygen when it expands during the time the patient exhales. |
| ⧫ Ventilate patient at approximate rate of:  • Adult - 10-12/minute (1 breath every 5-6 seconds)  • Child - 12-20/minute (1 breath every 3-5 seconds)  • Infant - 12-20/minute (1 breath every 3-5 seconds)  • Neonate 40-60/minute – to maintain heart rate > 100/minute  (AHA 2015) | | * If a pulse oximetry or wave form capnography measuring device is used, the appropriate ventilation rate is the least number of ventilations needed per minute to keep the neonate oxygenated and keep the end-tidal carbon dioxide (EtCO2) within the normal range.   ***Note: Do not hyperventilate the patient. Hyperventilation does not improve oxygenation,* *and may lead to hypocapnia and eventually respiratory alkalosis and cardiac arrest.*** |

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| **Skill Component** | **Key Concepts** | |
| ⧫ Reassess:   * Rate * Depth * Quality * SpO2 – if available * ETCO2 if ALS   ***\*\*Suction - if indicated*** | | • Continually assess respiratory status with each ventilation.  • Lung compliance provides information of successful inspiration or if there is interference with air delivery due to inadequate mask seal and airway or thoracic problems.  • In pediatric patients the resistance felt will generally be greater than in an adult due to the smaller size of the bronchi and bronchioles.  • In pediatric patients, hypoxia results in bradycardia which may lead to asystole. Reassess heart rate in neonates every 30-60 seconds and in infants and children every 1-2 minutes without stopping ventilations. |
| **TWO (2) RESCUER BAG-MASK VENTILATION**  **PROCEDURE** | | |
| ⧫ Instruct the 2nd rescuer to open the airway:  • Medical - head-tilt/chin-lift  • Trauma - jaw-thrust | • Avoid excessive movement of the patient. Excessive movement may lead to an airway obstruction.    • The 2nd rescuer is needed to maintain and ensure the airway remains open.  ***Note: If spinal motion restriction is needed, the 2nd rescuer will provide in-line axial stabilization***  • It is important to maintain a neutral position in pediatric patients to prevent hyper-flexion of the neck which may inhibit ventilations or occlude the airway (head is relatively large for size of the body).  ***Note: Place approximately two (2’) of padding under the shoulders or entire torso to achieve appropriate airway alignment.*** | |
| ⧫ Look inside the mouth and throat for a visible obstruction; if seen and it can be removed, remove it. |  | |
| ⧫ Insert oropharyngeal (OPA) or nasopharyngeal (NPA) airway – if indicated | • NPAs are contraindicated in infants (less than 12 months) due to the small diameter of the nostril and presence of adenoidal tissue.  • Use of a NPA may hinder the ability to achieve an adequate mask seal when using a BMV device. | |
| ⧫ Place mask over mouth and nose:  ***\*\* Instruct the 2nd rescuer to maintain a tight seal and patent airway using one of the following two-handed techniques:***  ***• Double C-E clamp technique***  ***• Thenar eminences (TE) technique*** | • The jaw-lift maneuver should be used when performing two-rescuer bag-mask-ventilations.  • Avoid using excess force while pressing the mask down on the face. Excess pressure on the eyeballs results in vagal stimulation – especially in pediatric patients.  • The top of the maskfits over the bridge of the nose and the bottom fits in the groove between the lower lip and the chin.  thenar• Excess pressure on soft tissue under the chin may result in airway obstruction.  • The thenar eminences allow the rescuer to do a good jaw-lift and create a more reliable seal while using the strongest muscles of the hands.   * The two (2) rescuer technique is the preferred method   *Also called the two-thumbs down technique*    Double C-E Thenar eminence  Technique Technique | |

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| **Skill Component** | | **Key Concepts** |
| ⧫ Ventilate the patient with appropriate tidal volume:  • Observe for effective rise and fall of chest  • Allow for adequate exhalation between ventilations | • Use only enough force to allow for good chest rise. Over-inflation causes gastric distention, which will decrease tidal volume by elevating the diaphragm.  • Exhalation requires more time than inspiration.  • The bag is refilled with oxygen when it expands during the time the patient exhales. | |
| ⧫ Ventilate the patient at approximate rate of:  • Adult - 10-12/minute (1 breath every 5-6 seconds)  • Child - 12-20/minute (1 breath every 3-5 seconds)  • Infant - 12-20/minute (1 breath every 3-5 seconds)  • Neonate 40-60/minute – to maintain heart rate to greater than 100/minute  (AHA 2015) | | * If working alongside ALS and a pulse oximetry or capnography wave form measuring device is used, the appropriate ventilation rate is the least number of ventilations needed per minute to keep the patient oxygenated and keep the end-tidal carbon dioxide (EtCO2) within the normal range (35-45mmHg).   *Note:* ***Do not hyperventilate the patient.*** *Hyperventilation does not improve oxygenation,* *and may lead to hypocapnia and eventually respiratory alkalosis and cardiac arrest.* |
| ⧫ Re-assess:   * Rate * Depth * Quality * SpO2 – if available   ***\*\*Suction - if indicated*** | | * Continually assess for improvement of the patient’s respiratory   status with each ventilation.  • Lung compliance provides information of successful inspiration or if there is interference with air delivery due to inadequate mask seal and airway or thoracic problems.  • In pediatric patients the resistance felt will generally be greater than in an adult due to the smaller size of the bronchi and bronchioles.  • In pediatric patients, hypoxia results in bradycardia which may lead to asystole. Re-assess heart rate in neonates every 30-60 seconds and in infants and children every 1-2 minutes without stopping ventilations. |
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| **REASSESSMENT**  **(Ongoing Assessment)** | | |
| **Skill Component** | | **Key Concepts** |
| ⧫ Re-assess the patient every five (5) minutes or sooner.   * Primary assessment * Relevant portion of the secondary assessment * Vital signs: Blood Pressure, Pulse, and   Respirations   * SpO2 * ETCO2 if ALS | | • This is a priority patient and must be re-evaluated at least every five (5) minutes. |
| ⧫ Evaluate the results of the ongoing assessment and compare to baseline condition and vital signs.  ***\*\*Manage patient condition as indicated.*** | | • Evaluating and comparing results assists with recognition of whether the patient is improving, remains the same, or if their condition is deteriorating. |
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| **PATIENT REPORT AND DOCUMENTATION** | | |
| **Skill Component** | | **Key Concepts** |
| § Verbalize/Document:  • Percent of oxygen/Liter flow  • Ventilation rate  • Size of nasopharyngeal or oropharyngeal adjunct  • Resistance encountered (lung compliance)  • Gastric distention - *if developed*  • Dentures and location - *if removed*  • Response to ventilation  - chest rise and fall  - color  - level of consciousness | | • Documentation must be on either the Los Angeles County EMS Report form, ePCR, or department Patient Care Record.  • Documenting reassessment information provides a comprehensive picture of patient’s response to treatment. |

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| **CARE of EQUIPMENT** | |
| **Skill Component** | **Key Concepts** |
| ⧫ Dispose of contaminated equipment using approved technique. | • Place contaminated equipment in plastic bag, seal, and dispose at designated sites.  *Note: When releasing patient to higher level of care personnel, leave*  *equipment to continue patient management.* |

Developed 11/00 Revised, 10/2018



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**UNPROTECTED AIRWAY**

**Supplemental Information**

**INDICATIONS:**

• Respiratory arrest

• Respiratory compromise (hypoxia)

**COMPLICATIONS:**

• Gastric distention

• Vomiting

**DEFINITIONS:**

• Capnography wave form – graphic depiction of the partial pressure of carbon dioxide exhaled with each breath. It provides an immediate picture of ventilation and indirectly measures metabolism and circulation.

• End-tidal carbon dioxide (EtCO2) – measures the carbon dioxide (CO2) concentration ~~of~~ in exhaled air– normal value 35-45mmHg

• Hypocapnia – too little carbon dioxide in the blood stream.

• Lung compliance (resistance) -- measure of how easy it is to inflate the lungs. If compliance is high, the lungs are easy to inflate. If compliance is low the lungs are hard to inflate (stiffer lungs).

• Pulse oximetry – measures the oxygen saturation in arterial blood (SpO2) -- normal values are 94-98% and 88-92% in COPD patients

• Respiratory alkalosis – rise in blood pH and may cause dizziness, tingling of the lips, hands or feet, headache, weakness, fainting and seizures and in extreme cases it can cause carpopedal spasms (contraction of the hands and feet).

**INDICATIONS OF ETCO2 VALUES:**

• The goal for most patients is to ventilate the patient such that the value is between 35-45mmHg

• In a spontaneously breathing patient the relationship between the measure EtCO2 value and respiratory status is more complex. Both abnormally high and abnormally low values of EtCO2 can indicate respiratory failure. In addition to primary respiratory processes, abnormal levels my represent compensatory mechanisms for a metabolic process, in particular low EtCO2 can also represent compensatory hyperventilation in metabolic acidosis.

• In a patient receiving positive pressure ventilation but not in cardiac arrest:

- If reading is greater than 45mmHg – CO2 is high and indicative of hypoventilation and respiratory acidosis.

- If reading is below 35mmHg – CO2 is low and indicative of hyperventilation and respiratory alkalosis.

• In a patient in cardiac arrest:

- A reading above 10mmHg indicates quality CPR

- A reading below 10mmHg signifies a bad prognosis

- A sudden increase above 35mmHg indicates ROSC

**NOTES:**

• The BMV device should have either no pressure-relief (pop-off) valve or a valve with an override feature to permit use of high pressures which may be necessary to achieve visible chest rise and effective ventilation.

• Using a BMV device with an oxygen reservoir attached to an oxygen source that delivers 15L/minute can provide a 90% or greater concentration of inspired oxygen. However, the effectiveness of the BMV device depends on the volume of gas that is squeezed out of the bag and if a proper seal is maintained.

• In cases of gastric distension, continue ventilations using appropriate airway maneuvers.

• In pediatric patients, hypoxia results in bradycardia which may lead to asystole. Re-assess heart rate in neonates every 30-60 seconds and in infants and children every 1-2 minutes without stopping ventilations.

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**Supplemental Information**

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| **COMPONENTS OF AN AIRWAY BAG** | |
| **BMV devices – adult, child, infant** | **Portable suction** |
| **OP/NP airways – all sizes** | **Suction equipment– various sizes** |
| **Nasal cannula** | **Portable oxygen cylinder and oxygen regulator** |
| **Simple face mask – adult, child, and infants** | **Pulse Oximeter** |
| **Non-rebreather – adult, child, and infants** | **Water soluble lubricant** |