

◆ Airway Management – Adult

Goals: Provide effective oxygenation and ventilation; recognize and alleviate respiratory distress or failure; provide necessary interventions quickly and safely to patients who need respiratory support; promptly identify a potentially difficult airway

Inclusion Criteria: Adults at least 14 years of age with signs/symptoms of respiratory distress or failure, or with evidence of hypoxemia and/or hypoventilation

Exclusion Criteria: Patients less than 14 years of age; newly born infants; patients with tracheostomies; patients for whom oxygenation and ventilation are adequate with supplemental oxygen alone, via nasal cannula or simple face mask

Refer to: [Airway Management – Pediatric Guidelines](#); [CPAP](#), [Cricothyrotomy](#), [Nasotracheal Intubation](#), [PAI](#) and [Tracheostomy/Stoma Care Procedures](#); [Neonatal Care](#), [Respiratory Distress – Adult](#) and [Respiratory Distress – Pediatric CPGs](#); and [Universal Care – Adult Guidelines](#)

1. Patient Assessment:

- a. History – Assess for:
 - i. Time of symptom onset
 - ii. Associated symptoms
 - iii. History of asthma, COPD or other breathing disorders
 - iv. Choking or other evidence of upper airway obstruction
 - v. History of trauma
- b. Physical Examination – Assess for:
 - i. Shortness of breath
 - ii. Abnormal skin color (cyanosis, pallor or mottling)
 - iii. Abnormal respiratory rate and/or effort
 - iv. Use of accessory muscles, including retractions
 - v. Patient positioning, e.g. “tripoding”
 - vi. Abnormal mental status
 - vii. Quality of air exchange, including depth and equality of breath sounds (all lung fields)
 - viii. Abnormal respiratory sounds: wheezing, rhonchi, rales, grunting or stridor
 - ix. Cough, including presence and color of sputum
 - x. Evidence of hypoxemia (do not assume low SpO₂ is due to equipment malfunction)
 - xi. Signs of difficult airway: short jaw or limited jaw thrust; small thyromental space; upper airway obstruction; large tongue; obesity; large tonsils; thick neck; craniofacial abnormalities or injuries; excessive facial hair; etc.

2. Treatment and Interventions:

NOTE: These guidelines present an **escalation of EMS care, beginning with supplemental oxygen** and possibly ending with endotracheal intubation or needle cricothyrotomy. Most patients would likely follow this sequence. Based on patient's clinical presentation and acuity, however, the EMS provider may need to proceed directly to more advanced airway techniques. **The foundation of all advanced airway management is effective basic airway management (BVM, positioning, suctioning, etc.). Nearly all patients can be effectively managed, at least temporarily, with supplemental oxygen and/or properly implemented basic airway maneuvers.**

NOTE: The goal of treatment is not *necessarily* “100% SpO₂” and/or 35-45 mmHg PetCO₂, but rather adequate oxygenation and ventilation for that particular patient, relief of respiratory distress/failure, and a patent airway (with or without an artificial, advanced airway, as clinically indicated).

- a. **Basic Airway Management, including continuous SpO₂ monitoring, to achieve SpO₂ 94-98%:**
 - i. Apply **supplemental oxygen** as per the [Respiratory Distress – Adult CPG](#) and other relevant, symptom-specific CPGs, using the following devices, as clinically indicated:
 1. Nasal cannula (NC)
 2. Simple mask
 3. Venti-mask (if available)
 4. Non-rebreather mask (NRBM)

- ii. If needed, additional respiratory support may be provided by **CPAP** (Continuous Positive Airway Pressure), a form of non-invasive positive pressure ventilation (NIPPV):
 - 1. **NOTE:** This is an ALS skill in the BioTel EMS System, unless BLS Providers have been individually trained and approved by the Medical Director
 - 2. Refer to the [CPAP Procedure](#) for indications, contraindications and procedural details
 - 3. Brief overview of patients possibly suitable for a CPAP trial:
 - a. Awake, oriented and able to cooperate (GCS at least 11)
 - b. Ability to maintain a patent airway
 - c. Respiratory rate at least 25 breaths per minute
 - d. Systolic BP at least 90 mmHg
 - e. Use of accessory muscles during spontaneous respirations
- iii. If needed, additional respiratory support may be provided for respiratory failure or respiratory arrest by assisted ventilation with a **bag-valve mask (BVM)**:
 - 1. BVM ventilation should be performed by two or three rescuers, if possible
 - 2. A proper sized mask completely covers the patient's nose and mouth and provides an effective seal around the cheeks and chin
 - 3. Ventilation should use the minimal volume and force needed to achieve chest rise
 - 4. The recommended rates of BVM ventilation for specific clinical conditions (post-cardiac arrest, medical, trauma or head injury) are explained below, **Section c**
 - 5. Proper BVM assisted ventilation should follow this useful mnemonic:
 - a. **C** Cervical spine motion restriction, when clinically indicated
 - b. **O** Oropharyngeal airway (OPA) in place (or NPA, if appropriate)
 - c. **P** Proper head and neck positioning
 - d. **E** Elevation of the jaw (gently pull the jaw into the mask)
 - e. **S** Seal the mask to the face (two hands)
 - f. —
 - g. **S** Steady, slow, single-hand, 1- to 1.5-second gentle bag squeeze, followed by quick release and full exhalation
 - h. **O** Oxygen supply: sufficient and functioning properly
 - i. **S** Suction available (always) and Sellick's maneuver, if needed (no longer routinely recommended, but may be helpful in selected circumstances)
- b. **Advanced Airway Management:**
 - iv. A **supraglottic airway (SGA) device** may be needed in patients tolerating BVM-assisted ventilation without resistance due to altered mental status (AMS) or unresponsiveness, or who need airway protection (e.g. during cardiac arrest):
 - 1. SGAs are designed for placement into posterior oropharynx, above the vocal cords, and may be inserted blindly and, in many cases, more rapidly than an endotracheal tube:
 - a. SGA placement is currently an ALS skill in the BioTel EMS System
 - b. SGAs are considered an "Advanced Airway" in the BioTel EMS System
 - 2. General indications to consider SGA placement:
 - a. Pulseless, apneic patient (without interrupting chest compressions)
 - b. Apneic patient who tolerates an OPA (absent gag reflex)
 - c. Need for advanced airway management when endotracheal intubation is unavailable
 - d. "Rescue" device for the "can't intubate, can't ventilate" scenario
 - 3. Relative contraindications:
 - a. Non-supine positioning
 - b. Patients with increased risk of regurgitation or aspiration
 - 4. Potential complications:
 - a. Regurgitation and aspiration
 - b. Device malposition
 - c. Gastric inflation
 - d. Bronchospasm or laryngospasm
 - e. Oropharyngeal edema or soft tissue damage
 - f. Laryngeal or hypoglossal nerve injury
 - g. Over-ventilation leading to respiratory alkalosis and decreased cardiac output

5. Patient preparation:
 - a. Don appropriate PPE and use isolation precautions (contact, droplet or airborne)
 - b. Maintain continuous SpO₂ monitoring and PetCO₂ monitoring
 - c. Ensure availability of portable suction device and suction cannula
 - d. Manually open the patient's airway
 - e. Insert adjunct (OPA or NPA)
 - f. Assist ventilation and preoxygenate with BVM at 8-10 gentle breaths per minute, using only enough volume to achieve chest rise: avoid over-ventilation!
6. SGA placement – general procedure:
 - a. Refer to the manufacturer's instructions/recommendations for the specific device
 - b. Lubricate the distal tip of the device
 - c. Position the patient properly (sniffing position ± “ramped up” (obese patient)), if cervical spine injury is not suspected
 - d. Perform a tongue-jaw lift
 - e. Insert device to proper depth (per manufacturer recommendations)
 - f. Inflate device cuff(s), if applicable to the device
 - g. Ventilate patient and confirm adequate ventilation (correct lumen and insertion depth) by auscultation over epigastrium, bilateral axillae and anterior lung fields
 - h. Adjust ventilation as needed (correct lumen and insertion depth)
 - i. Verify proper tube placement using continuous PetCO₂ and SpO₂ monitoring
 - j. Secure device using commercial tube holder, tape or other suitable means
 - k. Continue to provide assisted ventilation at proper rate & volume, avoiding over-ventilation due to excessive ventilation rate and/or volume
- v. **Endotracheal intubation** without use of paralytic agents is an advanced airway option for patients with absent gag reflex due to medical or traumatic conditions:
 1. Indications:
 - a. Less invasive methods are unavailable, unsuccessful or ineffective
 - b. “Can’t ventilate, can’t oxygenate” scenario
 - c. Severe burns (including smoke inhalation and/or thermal airway burns)
 - d. Severe multi-trauma
 - e. Altered mental status
 - f. Loss of normal, protective airway reflexes
 2. Potential complications:
 - a. Aspiration
 - b. Hypoxia and/or hypercarbia
 - c. Oral, dental or airway trauma
 - d. Worsening of cervical spine injury
 - e. ET tube malposition (esophageal or right mainstem intubation)
 - f. Adverse effects of sedation
 - g. Prolonged interruption of chest interruptions during CPR
 - h. Over-ventilation leading to respiratory alkalosis and decreased cardiac output
 3. In situations that warrant advanced airway placement, but the patient's level of consciousness precludes ET tube insertion, refer to the [Pharmacologically-Assisted Intubation \(PAI\) Procedure](#) (applies ONLY to agencies approved by the Medical Director)
 4. Patient/equipment preparation:
 1. Don appropriate PPE and use isolation precautions (contact, droplet or airborne)
 2. Maintain continuous ECG, SpO₂, and PetCO₂ monitoring
 3. Ensure availability of portable suction device and suction cannula
 4. Manually open the patient's airway
 5. Insert adjunct (OPA or NPA)
 6. Assist ventilation and preoxygenate with BVM at 8-10 gentle breaths per minute, using only enough volume to achieve chest rise: avoid over-ventilation!
 - b. Select the appropriate size ET tube
 - c. Select backup equipment: ET tubes ½ size larger and smaller, bougie, larger or smaller laryngoscope blade, SGA device, etc.
 - d. Lubricate the tip of the tube and insert the stylet

- e. Inflate cuff and check for cuff leak, then deflate cuff
- f. Check laryngoscope operation and bulb brightness
- g. Position the patient properly (sniffing position \pm "ramped up" (obese patient)), if cervical spine injury is not suspected
- 5. Endotracheal intubation procedure using direct laryngoscopy:
 - a. Insert laryngoscope into the patient's mouth and sweep tongue to the left
 - b. Elevate patient's mandible with laryngoscope to visualize vocal cords
 - c. Suction, as needed
 - d. Second rescuer may perform Sellick's maneuver, "BURP" maneuver or bimanual laryngoscopy, if needed, to improve vocal cord visualization
 - e. Introduce the ET tube between the vocal cords, to the proper depth
 - f. Inflate ET tube cuff to proper pressure and remove syringe from cuff inlet port
 - g. Confirm proper tube placement with continuous waveform capnography (PetCO₂)
 - 1. This is mandatory and must be documented in the ePCR
 - h. Confirm tube placement with additional methods*:
 - 1. Visualization of the tube passing between the vocal cords
 - 2. Absence of breath sounds over the epigastrium
 - 3. Presence of symmetrical breath sounds over bilateral lung fields
 - 4. Chest rise and fall with ET tube ventilation
 - 5. Tube fogging with ET tube ventilation
 - 6. Improving SpO₂: least reliable method
 - i. Secure the tube with commercial tube holder, tape, or another device
 - j. A cervical collar may help to reduce neck movement & risk of tube displacement
 - k. Continue to provide assisted ventilation at proper rate & volume, avoiding over-ventilation due to excessive ventilation rate, force and/or volume
- 6. Abandon ET intubation attempt and ventilate with 100% oxygen if ANY of the following events occurs:
 - a. Heart rate falls by 10 beats per minute below baseline
 - b. SpO₂ falls by 10 points below baseline
 - c. PetCO₂ rises by more than 5 mmHg above baseline
- 7. If ET intubation is unsuccessful after ONE attempt (defined as passage of the ET tube past the teeth), provide BVM ventilation and then insert an approved SGA device
- 8. *Additional tube placement confirmation guidelines:
 - a. No one single tube placement confirmation method ensures either correct or incorrect tube placement
 - b. More methods used to confirm tube placement = more accurate verification
 - c. Continuous waveform capnography (PetCO₂) monitoring must be used and documented during and at frequent intervals after intubation to monitor care of the intubated patient, especially after patient movement
 - d. Absence or loss of a 4-phase capnography waveform should prompt IMMEDIATE re-evaluation and reconfirmation of ET tube position:
 - 1. During CPR or other low-perfusion states, the PetCO₂ waveform will be smaller, but should still be detectable
 - 2. During prolonged cardiac arrest, or in the setting of massive pulmonary embolism or poor chest compressions PetCO₂ may be very low, falsely suggesting improper tube placement
 - 3. NOTE: PetCO₂ may be normal with right mainstem intubation
 - e. The value of SpO₂ measurement to confirm ET tube placement is limited:
 - 1. A normal reading does not exclude respiratory distress or the need for advanced airway management
- 9. If there is ANY doubt about the proper placement of an ET tube, REMOVE the tube and ventilate the patient with a BVM while preparing for insertion of an SGA rescue device
- vi. **Nasotracheal intubation** may be a good option for certain **spontaneously breathing** patients:
 - 1. Indications:
 - a. Conscious, spontaneously breathing patients with intact gag reflex (e.g. COPD, asthma, burns)

- b. Unconscious patients with GCS less than 8 due to trauma or medical conditions
 - c. Patients with possible cervical spine injury whose injury may be exacerbated by neck movement
 - d. Significant swelling of lips, tongue or mouth (e.g. angioedema) or limited mouth opening
- 2. Contraindications:
 - a. Absolute:
 - 1. Apnea
 - 2. Age less than 14 years of age
 - 3. Severe traumatic or congenital midface deformity
 - 4. Nasal airway obstruction
 - b. Relative:
 - 1. Suspected basilar skull fracture
 - 2. Coagulopathy
 - 3. Anticoagulants
 - 4. Acute hypertension
 - 5. Suspected elevated intracranial pressure (trauma, stroke, etc.)
- 3. Refer to the [Nasotracheal Intubation Procedure](#) for equipment requirements, procedural details and potential complications
- vii. **Needle Cricothyrotomy** may be indicated in certain, extenuating circumstances when risk of death for not escalating airway management may outweigh risk of procedural complications:
 - 1. Possible indications:
 - a. Apnea with inability to ventilate and/or oxygenate AND failure of other measures
 - b. Massive facial trauma
 - 2. NOTE: This procedure provides limited, temporary ability to oxygenate, but little ability to ventilate – hypercarbia will develop eventually
 - 3. Refer to the [Cricothyrotomy \(Needle\) Procedure](#) for equipment requirements, procedural details and potential complications
- viii. **Percutaneous/surgical cricothyrotomy** may be indicated in extremely rare circumstances:
 - 1. This procedure is restricted in the BioTel EMS System to use only by ALS Providers specifically trained to perform it and authorized by the Medical Director
 - 2. Equipment requirements and procedural details depend on the device used
- c. Assisted ventilation rates and PetCO₂ values – general guidelines:
 - i. Continuous ECG, SpO₂, and waveform capnography/PetCO₂ monitoring shall be used for every patient with moderate or severe respiratory distress, shock or hemodynamic instability, critical illness or injury, and/or the need for advanced airway management
 - ii. PetCO₂ monitoring/waveform analysis helps to guide assisted ventilation rate and volume
 - iii. Avoid excessive positive-pressure ventilation (rate, volume or force) to reduce risk of:
 - 1. Impaired venous return and cardiac output
 - 2. Impaired cerebral perfusion
 - 3. Barotrauma (pneumothorax and direct lung injury)
 - 4. Gastric insufflation, with regurgitation and pulmonary aspiration
 - iv. Assisted ventilation via advanced airway should be performed as follows:
 - 1. Technique: gentle, one-handed bag squeeze over 1 to 1.5 seconds each
 - 2. Volume: sufficient to achieve chest rise
 - 3. Rate: 8 to 10 breaths per minute, adjusted judiciously to maintain PetCO₂ values within normal limits, unless clinically indicated otherwise, such as:
 - a. During CPR, do not attempt to titrate PetCO₂ levels by adjusting ventilation rate
 - b. During post-cardiac arrest (ROSC), do not exceed 10-12 breaths per minute, even if PetCO₂ level is transiently elevated (as expected)
 - c. If hypovolemia or severe pulmonary expiratory obstruction (e.g. asthma or COPD) is present, reduce rate to approximately 6 breaths per minute
- d. **Rapidly transport the patient to the closest appropriate hospital for airway stabilization when respiratory failure cannot be successfully managed in the prehospital setting**