Airway Management – Pediatric

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: Infants and children less than 14 years of age with signs/symptoms of respiratory distress or failure, or with evidence of hypoxemia and/or hypoventilation

Exclusion Criteria: Patients older than 14 years of age; patients with tracheostomies; patients for whom oxygenation and ventilation are adequate with supplemental oxygen alone, via nasal cannula or simple mask **Refer to:** Airway Management – Adult Guidelines; CPAP, Cricothyrotomy, Nasotracheal Intubation, PAI and Tracheostomy/Stoma Care Procedures; Neonatal Care, Respiratory Distress – Adult and Respiratory Distress – Pediatric CPGs; and Universal Care – Pediatric Guidelines

- Refer to Airway Management Adult Guidelines for general guidance about airway management and advanced airway decision-making
- > This section will focus on the **pediatric-specific** considerations that differ from adult management
- 1. Patient Assessment As per adult patient assessment, Pediatric Assessment Triangle, AND:
 - a. History Assess for *additional* history:
 - i. History of prematurity (infants)
 - ii. Associated symptoms, such as poor feeding and fever
 - b. Physical Examination Assess for:
 - i. Shortness of breath
 - ii. Abnormal skin color (cyanosis, pallor or mottling)
 - iii. Age-dependent abnormal respiratory rate and/or effort
 - iv. Use of accessory muscles, including retractions, nasal flaring or head bobbing (infants)
 - 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

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 pediatric 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%:

- Apply supplemental oxygen in the "sniffing" position (using a small shoulder roll, as needed), as per the Respiratory Distress – Pediatric 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; however, properly trained BLS and ALS Providers may be authorized by the Medical Director to perform *pediatric* CPAP
- 2. Refer to the CPAP Procedure for indications, contraindications and procedural details
 - a. Minimum age: at least 6 years and pediatric equipment must be available
- 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 (or significant tachypnea for age)
 - d. Systolic BP at least (70 + 2(age in years) (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. As per Airway Management Adult Guidelines, using pediatric equipment

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. General guidelines:
 - 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
 - c. SGA placement in pediatric patients may be performed only if pediatric equipment is available
 - 2. General indications, contraindications and potential complications:
 - a. As per Airway Management Adult Guidelines
 - 3. Patient preparation:
 - a. As per Airway Management Adult Guidelines
 - b. Assist ventilation and preoxygenate with BVM at 12-20 gentle, one-handed breaths per minute (or as appropriate for the age and underlying condition), using only enough volume to achieve chest rise: avoid over-ventilation!
 - 4. SGA placement general procedure:
 - a. As per Airway Management Adult Guidelines, using pediatric equipment
- v. **Endotracheal intubation** without use of paralytic agents is rarely indicated for pediatric patients in the out-of-hospital environment:
 - 1. Indications, contraindications and potential complications:
 - a. As per Airway Management Adult Guidelines
 - 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)
 - 3. Patient/equipment preparation:
 - a. Don appropriate PPE and use isolation precautions (contact, droplet or airborne)
 - b. Maintain continuous ECG, SpO₂, and PetCO₂ monitoring
 - c. As per Airway Management Adult Guidelines, using pediatric equipment
 - 4. Endotracheal intubation procedure using direct laryngoscopy:
 - a. As per Airway Management Adult Guidelines, using pediatric equipment
 - b. A straight ("Miller") laryngoscope blade is preferred
 - c. Suggested pediatric ET tube sizes:

Age	Size (mm) - Uncuffed	Size (mm) - Cuffed
Premature	2.5	
Term to 3 months	3.0	
3 to 7 months	3.5	3.0
7 to 15 months	4.0	3.5
15 to 24 months	4.5	4.0
2 to 14 years	[age (yr)/4] + 4	[age (yr)/4] + 3.5

- d. Inflate the cuff with air to "minimal leak", or use an ET tube cuff manometer and inflate to no more than 20 cm H_2O pressure
- e. Continue to provide assisted ventilation at proper rate & volume, avoiding overventilation due to excessive ventilation rate, force and/or volume
- 5. 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
- 6. If ET intubation is unsuccessful after ONE attempt (defined as passage of the ET tube past the teeth), provide BVM ventilation and consider insertion of an approved pediatric SGA device, if available
- 7. Additional tube placement confirmation guidelines:
 - a. As per Airway Management Adult Guidelines
 - b. NOTE: Because of transmission of breath sounds in the pediatric chest, symmetry is best confirmed by auscultation in the bilateral axillae
- 8. 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 is generally not used in pediatric patients
 - 1. 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. As per Airway Management Adult Guidelines
 - 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. The online Medical Command Physician at BioTel must authorize pediatric use
- c. Assisted ventilation rates, PetCO₂ values and ECG/SpO₂ monitoring general guidelines:
 - i. Continuous ECG, SpO₂, and waveform capnography/PetCO₂ monitoring shall be used for every acutely ill or injured pediatric patient with moderate or severe respiratory distress, shock or hemodynamic instability, critical illness or injury, and/or need for advanced airway management
 - ii. PetCO₂ monitoring/waveform analysis helps to guide assisted ventilation rate and volume
 - 1. Avoid excessive positive-pressure ventilation (rate, volume or force) to reduce risk of complications, as per Airway Management Adult Guidelines
 - iii. Assisted ventilation via advanced airway should be performed as follows:
 - 1. Technique & volume: As per Airway Management Adult Guidelines
 - 2. Rate: 10 to 20 breaths per minute, or as needed, *depending on age*, adjusted judiciously to maintain normal PetCO₂ values, unless clinically indicated otherwise, such as:
 - a. During CPR and ROSC: As per Airway Management Adult Guidelines
 - b. If hypovolemia or severe pulmonary expiratory obstruction (e.g. asthma) is present, consider reducing rate to approximately 6 to 8 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