Pediatric Airway

Assess Respiratory Rate, Effort, Oxygenation
Is Airway / Breathing Adequate?

YES → Supplemental oxygen
Goal oxygen saturation ≥ 92%

Exit to
Appropriate Protocol(s)

NO

Basic Maneuvers First
-open airway chin lift/ jaw thrust
-nasal and/ or oral airway
-Bag-valve mask (BVM) +/- PEEP

Spinal Motion Restriction
Procedure / Protocol TB 8
if indicated

Consider AMS Protocol UP 4

Respiratory Distress with a
Tracheostomy Tube
Protocol AR 10
if indicated

Capnography Monitoring

- **End-tidal (EtCO2) monitoring is mandatory following placement of an endotracheal tube.**
- **EtCO2 monitoring is mandatory following placement of a BIAD once available on scene.**

Protocols AR 3, 5, and 6 should be utilized together (even if agency is not using Drug Assisted Airway Protocol) as they contain useful information for airway management.

Airway Obstructed → YES

- Airway Foreign Body Obstruction Procedure
- A: Direct Laryngoscopy ***Optional***
- P: Airway Cricothyrotomy Needle Procedure **See Pearls Section**

NO

Breathing / Oxygenation Support needed → YES

- Supplemental Oxygen
  BVM
  Maintain
  Oxygen Saturation ≥ 92 %
- B: Airway BIAD Device Procedure ***if indicated***
- A: Orotracheal Intubation Procedure ***Optional***
- P: Chest Decompression Procedure ***if indicated***
- P: Consider Airway, Drug Assisted Protocol AR 3 ***if available***
- P: Post-intubation / BIAD Management Protocol AR 8 ***if indicated***

NO

Monitor /Reassess
Supplemental Oxygen
if indicated

Exit to
Appropriate Protocol(s)

Failed Airway:

Unable to Ventilate and Oxygenate ≥ 90% during or after one (1) or more unsuccessful intubation attempts

and/ or
Anatomy inconsistent with continued attempts

and/ or
Three (3) unsuccessful attempts by most experienced Paramedic/ AEMT.

Exit to
Pediatric Failed Airway
Protocol AR 6

Notify Destination or
Contact Medical Control

Airway Respiratory Protocol Section

Pediatric Airway

THE PRINCIPLES OF AIRWAY MANAGEMENT IN THE PEDIATRIC PATIENT ARE GENERALLY THE SAME AS IN THE ADULT.

4 Most Important Elements to Consider in Airway Management:

- **Hypoxia**
- **Aspiration**
- **Hypotension**
- **Acidosis**

- Strategy in airway management is to prevent, or correct, these 4 problems with proper oxygenation and pre-oxygenation, positioning, suctioning, fluid resuscitation, and vasopressor use.
- We cannot directly treat acidosis, but proper resuscitation will allow the body to correct acidosis.

Airway management in the pediatric patient has many challenges, including drug dosing and equipment sizes along with the anxiety of managing a critically ill child.

1. Differences are most pronounced in the first 2 years of life after which the pediatric airway evolves into that of adult around age 8.
2. Must appreciate age and size related factors which evolve throughout development.
   - Pediatric airway is prone to obstruction due to poor positioning, swelling, and tongue tends to be large occupying great deal of the oropharynx.
   - Large tonsils and adenoids, which may bleed during procedures.
   - Allow the pediatric patient to assume a position of comfort if able to maintain their own airway.
   - Pediatric airway is more anterior especially in children 2 years and younger. The glottic opening is at C 1 in infancy and transitions to C 3 - C 4 by age 7 and then to C 5- C 6 by age 8 which is similar to adults. Cricoid ring is the narrowest portion of airway. This means the glottis will be toward 12 o'clock during laryngoscopy.
   - Recommended Miller intubation blade until after age 3.
   - Large occiput which causes flexion of the airway and also causes tongue to obstruct against the posterior pharynx.
3. Need for alternative airway techniques especially a mastery of the BVM with use of NP and OP airways as well as igel®.

Positioning for Airway Management:

- Airway management should not occur with the patient in a flat position. Head of patient should always be elevated.
- Pillows, blankets, towels, and the EMS stretcher all are able to properly position the patient.
- Head should be elevated 10 -20°. Intubation attempts should be performed with patient on the cot and properly positioned.

Formula for estimating ETT size in children > 1 year of age:

- Cuffed tubes can be used at any age. When used in children ≤ 8 subtract 0.5 mm from estimated ETT.
- Use minimal ETT balloon occlusion pressure to effect a seal. Put just enough air in the ETT cuff to prevent leak.

Airway Respiratory Section

Pearls

This protocol is for use in patients who FIT within a Pediatric Medication/ Skill Resuscitation System Product.

- **For the purposes of this protocol, a secure airway is when the patient is receiving appropriate oxygenation and ventilation.**
- **If an effective airway is being maintained by BVM with continuous pulse oximetry values of ≥ 90%, it is acceptable to continue with basic airway measures.**
- **Ventilation rate:**
  30 for Neonates, 25 for Toddlers, 20 for School Age, and for Adolescents the normal Adult rate of 10 - 12 per minute. Maintain EtCO2 between 35 - 45 and avoid hyperventilation.
- **Ketamine for airway intervention and/ or sedation purposes:**
  Ketamine may be used in pediatric patients (fit within a Pediatric Medication/Skill Resuscitation System product, ≤ 15 years of age, or ≤ 49 kg) with DIRECT ONLINE MEDICAL ORDER by the system MEDICAL DIRECTOR or ASSISTANT MEDICAL DIRECTOR only.
  Agencies using Ketamine in the pediatric population must also be using in their adult population.
- **KETAMINE:**
  Ketamine may be used with or without a paralytic agent in conjunction with either an OPA, NPA, BIAD or endotracheal tube. BIAD is preferred over endotracheal tube until hypoxia and/ or hypotension are corrected.
  Ketamine may be used during the resuscitation of hypoxia or hypotension in conjunction with airway management. Once hypoxia and hypotension are corrected, use of a sedative and paralytic can proceed if indicated.
  Ketamine may be used in the dangerously combative patient requiring airway management IM. IV/ IO should be established as soon as possible.
  Ketamine may be used for sedation once a BIAD or endotracheal tube are established and confirmed.
  Agencies using Ketamine must follow Standards Policy: Medial Policy Section Ketamine Program Requirements. Medical Policy 2.
- **Intubation:**
  Attempt defined as laryngoscope blade passing the teeth or endotracheal tube passed into the nostril.
  Use of a stylet is recommended in all pediatric intubations.
  Endotracheal tube: Depth = 3 x the diameter of the ETT. Estimated Size = 16 + age (years) / 4. Term newborn = 3. 5 mm.
  If First intubation attempt fails, make an adjustment and try again: (Consider change of provider in addition to equipment)
- **NC EMS Airway Evaluation Form:**
  Fully complete and have receiving healthcare provider sign confirming BIAD or endotracheal tube placement.
  Complete online in region specific *ReadyOp* and upload completed form.
  Complete when Ketamine, Etomidate, Succinylcholine and/ or Rocuronium or used to facilitate use of a BIAD and/ or endotracheal intubation. Paramedics/ AEMT should consider using a BIAD if endotracheal intubation is unsuccessful.
- Secure the endotracheal tube well and consider c-collar in pediatric patients (even in absence of trauma) to better maintain ETT placement. Manual stabilization of endotracheal tube should be used during all patient moves / transfers.
- **Airway Cricothyrotomy Percutaneous Needle Procedure:**
  Indicated as a lifesaving / last resort procedure in pediatric patients < 10 years of age.
  Very little evidence to support it's use and safety.
  A variety of alternative pediatric airway devices now available make the use of this procedure rare.
  Agencies who utilize this procedure must develop a written procedure, establish a training program, maintain equipment and submit procedure and training plan to the State Medical Director/ Regional EMS Office.
  ≥ 10 years: Surgical cricothyrotomy or commercial kits based on agency preference recommended.
- **DOPE: D**isplaced tracheostomy tube/ ETT, **O**bstructed tracheostomy tube/ ETT, **P**neumothorax and **E**quipment failure.