Model Clinical Guideline: Prehospital Airway Management

The management of pediatric and adult airway emergencies in the out-of-hospital setting is accomplished in a unique environment by clinicians with skill sets and resources different from clinicians in the in-hospital setting.

This model guideline reflects an evidence-informed review focused on out-of-hospital airway management and the Prehospital Airway Management Evidence Based Guideline Technical Expert Panel's (TEP) consensus recommendations. This document acts as an update to the *National Model EMS Clinical Guidelines* V. 3.0, Airway Management Guideline. References to the larger *Guidelines* document appear in brackets with blue, underscored font.

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Aliases

Airway management, airway emergency, ventilation, bag mask ventilation (BMV), supraglottic airway (SGA), endotracheal intubation (ETI)

Patient Care Goals

1. Establish and/or maintain a patent airway.
2. Optimize patient outcomes, support/correct oxygenation and/or ventilation, and provide airway protection using the least invasive and most effective manner at the scene and during transport.
3. Minimize complications from airway interventions.
4. Perform clinical assessments and monitor the patient's overall physiological response to the interventions.

Patient Presentation

Inclusion Criteria:

Patients with one or more of the following:

1. To establish airway patency/protect the airway in an actual or impending impaired airway.
2. To support oxygenation.
3. To support ventilation.

Exclusion Criteria

1. Chronically ventilated patients
2. Newborn patients
3. Complications of tracheostomy (See Tracheostomy Management Guideline)

Patient Management

Multiple factors combine to form the most appropriate airway management plan, including, but not limited to, etiology, patient age, unique features, scene factors, and transport considerations. In addition, the airway management styles will depend upon the individual EMS clinician's scope of practice and the EMS agency's resources and credentialing programs, including education, training, competency assurance, quality assessment, and medical oversight.

Assessment

1. History – Assess for:
   a. Time of onset of symptoms,
   b. Severity of shortness of breath, sensation of dyspnea,
   c. Pace of symptoms: gradual, progressive, paroxysmal, persistent or intermittent
   d. Palliating or provoking factors,
   e. Associated symptoms and triggers for dyspnea (e.g., exertion, exercise, lying flat, environmental factors),
   f. History of asthma or other respiratory disorders,
   g. Recent infection/other exposures/cough: presence, productive,
   h. Patient medications (especially recently added or lack of needed medicine),
   i. History of trauma,
   j. History of overdose or intoxication,
   k. Prior similar episodes (e.g., intubation, ICU stay, anaphylaxis, angioedema, airway surgery, tracheostomy). If prior episodes, what has helped in the past (medications, interventions). Home interventions for symptoms (e.g., increased home oxygen, nebulizer).
2. Physical Examination – Assess for:
   a. Initial impression of severity and patient status, skin color, cyanosis, pallor, diaphoresis,
   b. Evidence of upper airway obstruction (including choking),
   c. Abnormal respiratory pattern, rate and/or effort,
   d. Use of accessory muscles,
   e. Jugular venous distention (JVD),
   f. Quality of voice, number of words/sentences spoken,
   g. Auscultate: Quality of air exchange, including depth of respiration and equality of breath sounds note abnormal breath sounds (e.g., wheezing, rhonchi, rales, or stridor),
   h. Skin color (cyanosis or pallor), presence of diaphoresis,
   i. Mental status, including anxiety, stupor, obtundation,
   j. Airway obstruction with foreign body or swelling (e.g., angioedema, posterior pharyngeal, and laryngeal infections),
   k. Signs of a difficult airway,
   l. Signs of fluid overload (e.g., JVD, ascites, peripheral edema),
   m. Traumatic injuries impairing upper and lower airway anatomy and physiology.
   n. Pediatric Assessment:
      i. For Initial impression of severity, use the Pediatric Assessment Triangle:
         - Appearance: awake, alert, sitting upright, confused, sleepy, unresponsive,

- Work of breathing: tachypnea, retractions, grunting, nasal flaring,
- Circulation: pink, well-perfused, mottled, pale, cyanosis.

ii. Evidence of upper airway obstruction - Stridor can indicate infectious etiologies (i.e., croup, epiglottis, tracheitis) or a foreign body.

iii. Abnormal respiratory pattern, rate and/or effort - Tachypnea and retractions are very common in children with respiratory distress. Evaluate for excessive abdominal breathing, weak crying, and the inability to speak in full sentences.

iv. Use of accessory muscles - Retractions, including subcostal, intercostal, and supraclavicular.

v. Skin color - Cyanosis is uncommon and a late-finding in young children with respiratory distress. Pallor and mottled skin are earlier signs that are important to notice.

vi. Mental status - Consolability is an important finding in children. Those who are consolable likely have less severe illness, however, be cognizant of young children who are not exhibiting the typical stranger anxiety. A young child who is not bothered by your clinical care can be a sign of severe illness.

Monitoring - Implement emergent interventions and monitoring [Refer to Universal Care Guideline]

1. Monitoring during airway management includes frequent assessment of vital signs, adequate ventilatory rates/volumes, end tidal CO2 monitoring, and continuous pulse oximetry.
2. Patients with significant respiratory distress should have continuous pulse oximetry and waveform capnography monitoring to assess and guide therapy.
   a. Pulse oximetry is indicated to assess oxygenation.
   b. Quantitative waveform capnography, either nasal prong or in-line $EtCO_2$ is indicated:
      i. To confirm placement and ongoing function of invasive airway management.
      ii. To assess and monitor ventilatory status in patients with significant respiratory distress, with or without airway adjuncts.
      iii. To evaluate acid-base status in critically ill patients. As a monitoring and decision-making tool for patients with significant respiratory distress, interpretation of the capnography waveform and $EtCO_2$ values assist in determining the appropriate course of treatment and corresponding response.
3. Patients with altered mental status should be monitored to ensure adequate airway protection, oxygenation, and ventilation.

Treatment and Interventions

Disease Specific Good Practice Statements for Airway Management

Adult Trauma and Medical Emergencies	Adult Out of Hospital Cardiac Arrest (OHCA)
BVM ventilation is the starting point of positive pressure ventilation for adults with injuries and medical emergencies requiring airway management and may progress to SGA or ETI as needed. All decisions for progression in airway management should be guided by the patient's clinical status based on ongoing assessment, monitoring, transport, and environmental considerations. Patients requiring invasive airway management likely require medication assistance for airway placement. SGA should be considered as the primary invasive modality. In systems with appropriate resources and established programs continually assessing intubation performance and demonstrating high ETI success, ETI may be considered.	BVM ventilation is the starting point of positive pressure ventilation for adults with OHCA. Progression to invasive modalities may be necessary but should not compromise chest compressions. All decisions for progression in airway management should be guided by the patient’s clinical status based on ongoing assessment, monitoring, transport, and environmental considerations. SGA should be considered as the primary invasive modality. In systems with appropriate resources and established programs continually assessing intubation performance and demonstrating high ETI success, ETI may be considered.
Pediatric Trauma, Medical Emergencies, and OHCA	
Pediatric patients are a heterogenous group, and airway management strategies must optimize ventilation and oxygenation while minimizing complications. BVM is the starting point of positive pressure ventilation and may progress to SGA, however, progression to ETI should be done rarely in the face of lower ETI success rates, higher complication rates, and lower patient volumes leading to decreased experience in this population. All decisions should be guided by the clinical status of the patient based on ongoing assessment, monitoring, etiology, and expected clinical course.	

General Steps in Airway Management

Implement airway management interventions in an escalating fashion to meet patient-centered goals of care. Situations are often dynamic; reassessments and decisions must be iterative. Attention to foundational steps of airway management may be effective and remove the need for more advanced techniques.

1. **Administer oxygen** for hypoxemia and titrate to a target SPO_2 of 94–98%.
   a. Depending on patient presentation, this may be accomplished with nasal cannula, non-rebreather, BVM, or non-invasive positive pressure ventilation (NIPPV).
   b. Even in apneic patients with a pulse, starting passive oxygenation while escalating interventions are implemented may be useful.
   c. Maximal oxygen supplementation via nasal cannula or face mask at highest flow should be provided during CPR and pre-oxygenation prior to invasive airway management attempts.
2. **Open, position, and maintain patent airway,** if needed,
   a. Patients with severe dyspnea should be left in their position of comfort whenever possible.
   b. Provide head tilt/chin lift or jaw thrust if concern for potential spinal injury unless contraindicated.
   c. Patient positioning can significantly impact respiratory mechanics.

i. Patients with severe facial trauma and ongoing hemorrhage may benefit from the recovery position.
ii. Patients who are obese or pregnant can experience airway compromise in the supine position. Elevating the head of the bed or padding (shoulders, occiput) can assist with opening airway and respiratory mechanics. This can both improve the ability to ventilate and limit aspiration.
iii. Torso elevation or left lateral decubitus for late-term pregnant patients.

d. Suction airway as needed with appropriate device.
e. Oropharyngeal airways (OPA) and/or nasopharyngeal airways (NPA) should be placed to maintain a patent airway and make BVM ventilation more effective, unless contraindicated.
f. For patients with **tracheostomy** in respiratory distress, see Tracheostomy Management Guideline.

3. **Non-invasive positive pressure ventilation (NIPPV**) should be considered early for severe ventilatory distress or impending respiratory failure of any etiology.
   a. NIPPV options include continuous positive airway pressure (CPAP), bilevel positive airway pressure (BiPAP), bi-level nasal CPAP, purpose-built humidified, heated high-flow oxygen by nasal cannula and assisted mask ventilation with positive end expiratory pressure (PEEP).
      i. In pediatric patients too small for CPAP masks, BVM with PEEP valve may augment breathing and offer non-invasive positive pressure ventilation.
   b. NIPPV can also be used to improve oxygenation pre-intubation.
   c. NIPPV can be used in patients with altered mental status if closely attended and prepared to intervene as necessary.
4. **Use bag-valve-mask (BVM) ventilation** in the setting of respiratory failure or arrest.
   a. Two-person BVM ventilation with two-thumbs-up mask hold is preferred when possible.
   b. PEEP should be used with BVM.
      i. 5 cmH_20 is generally an appropriate initial PEEP setting.
      ii. Increase PEEP in stepwise fashion for persistent hypoxia.
      iii. Allow time for the patient to equilibrate with each change.
         - Aim for the lowest PEEP needed to adequately ventilate the patient, as higher PEEP results in greater negative hemodynamic impact.
   c. In patients without primary pulmonary pathology (e.g., COPD), target $EtCO_2$ of 35 to 45 mmHg. Patients with specific disease processes such as acute acid-base disorders (e.g., DKA, lactic acidosis due to severe sepsis or trauma), acute respiratory failure due to primary pulmonary pathology, or post-cardiac arrest will have different $EtCO_2$ parameters due to their underlying disease.
5. **Consider supraglottic airway (SGA) for any unconscious patient without gag reflex**:
   a. Consider using an appropriately sized SGA if BVM with OPA/NPA alone is not effective or inappropriate.
      i. Ventilation via SGA is often easier than via BVM.
   b. When escalating airway management strategies, use of an SGA is especially important in children as prehospital endotracheal intubation is an infrequently performed skill in this age group and has not been shown to improve outcomes over prehospital BVM or SGA.

6. **Consider endotracheal intubation (ETI)**:
    a. When less-invasive methods (two-person BVM, SGA placement) are ineffective or inappropriate.
    b. Other indications may include but are not limited to, oxygenation, ventilation, airway patency, and protection.
    c. If the patient's clinical course is expected to decline and require protection, intubation may be indicated.
    d. Preoxygenation and resuscitation prior to intubation are critical to patient safety.
    e. Multiple ETI attempts contribute to complications and poor patient outcomes. Consider the following to increase first pass success:
        i. Use of a checklist,
        ii. Optimal patient positioning,
        iii. Video laryngoscopy,
        iv. Bougie (if standard geometry laryngoscope),
        v. Using the most experienced EMS Clinician.
7. **Invasive Airway (SGA and ETI) Placement:**
    a. Optimize patient for first-pass success with pre-procedure resuscitation, preoxygenation, positioning, sedatives, and paralytics as indicated by patient presentation.
        i. In certain settings, sedatives and paralytics may improve first pass success and overall success of airway management. However, such medications have not demonstrated improvement in patient survival. Because of the potential risks associated with using these medications, they should be reserved exclusively for EMS clinicians working within EMS systems that have established education, competency maintenance, quality improvement, and Medical Direction programs that demonstrate proficiency with airway management as a whole and medication facilitated airway management specifically.
        ii. Adequate preoxygenation (typically considered SpO2 ≥93% for at least 3 minutes) and the use of high flow apneic oxygenation with nasal cannula can decrease odds of hypoxia during airway attempts.
    b. Monitor clinical signs, pulse oximetry, cardiac rhythm, and blood pressure during invasive airway placement.
    c. Establish threshold values for safe initiation of SGA placement and ETI, as well as values requiring cessation of the attempt. These thresholds should be physiologically based and include oxygen desaturation, bradycardia, or hypotension.
8. **Post-Invasive Airway Management**
    a. Inflate endotracheal tube cuff or SGA cuff (if applicable) with minimum air to seal airway and eliminate air leaks. If available, an ETT cuff manometer can be used to measure and adjust the ETT cuff pressure to the recommended 20 cmH_20 pressure.
    b. Confirm invasive airway placement (ETT, SGA) with visual confirmation, absent gastric sounds, and bilateral breath sounds. Waveform capnography for confirmation is the standard of care and should be mandatory.
    c. Secure device manually. Once proper position is confirmed, secure the ETT or SGA with tape, twill, or appropriate commercial device.
        i. Note location of ETT or SGA at incisors or gum line and assess frequently for tube movement/displacement using continuous waveform capnography and visual inspection.

ii. Head movement in children has been demonstrated to cause airway device displacement, therefore, consider cervical motion restriction to limit movement of the head and neck.

d. Continuously monitor correct airway placement with repeat physical assessment and continuous waveform capnography during treatment and transport, paying particular attention to reassessing after each patient movement.

e. Manual ventilation

i. Tidal volume:

- Over-inflation (e.g., excessive tidal volume), excessive pressure and overventilation (e.g., excessive minute ventilation) are undesirable and harmful.
- Without devices to measure BVM performance (e.g., tidal volume, $EtCO_2$), ventilate with just enough volume to see subtle chest rise.
  - Consider compressing an adult bag with one hand or two to three fingers.
  - Consider using bags that provide volume indicators.
  - Consider mechanical ventilators set to approximately 6 cc/kg ideal body weight.

ii. Initial Rate (target to $EtCO_2$):

- Adult: 10–12 breaths/minute
- Child: 20–30 breaths/minute
- Infant: 20–30 breaths/minute

iii. Continuously monitor $EtCO_2$ to guide tidal volume and minute ventilation.

f. Mechanical ventilation should be considered following invasive airway placement if available. See Mechanical Ventilation (Invasive) Guideline.

g. Patients with an invasive airway should be provided and maintained with appropriate analgesia and sedation titrated to an appropriate target level using the Richmond Agitation-Sedation Scale (RASS) score or similar scale.

h. Consider PEEP adjustment to achieve oxygenation goals (see above).

9. Gastric decompression can improve oxygenation and ventilation and should be strongly considered in any patient with positive pressure ventilation, especially in pediatric patients.
10. When patients cannot be oxygenated/ventilated effectively using the above interventions, or when conventional airway approaches are impossible, surgical airway management is a reasonable option if the clinician has competency in the procedure and risk of death for not escalating airway management seems to outweigh the risk of a procedural complication. One of the greatest risks of a bad outcome for surgical airway is a delay in using the technique.
    a. Simpler approaches to surgical airways are often more successful than complicated commercial devices.

Patient Safety Considerations

1. Prioritize suctioning to limit aspiration. This may reduce hospital-acquired pneumonia, ICU length of stay, and mortality.
2. Head elevation to 30-45 degrees when tolerated and without contraindication is associated with lower rates of ventilator associated pneumonia in the ICU setting and is encouraged for

prehospital patients.

3. Patients with suspected traumatic brain injury (TBI) who are undergoing airway management should also have their heads elevated if tolerated and clinically appropriate.
4. Avoid excessive pressures or tidal volumes during BVM ventilation. This minimizes the risk of barotrauma, overventilation, and related venous return/preload/cardiac output reduction.
5. Routine use of sedation is not recommended for treatment of anxiety in patients on NIPPV. Anxiety should be presumed due to hypoxia or inadequate minute ventilation and treated primarily with ventilatory support. The key to successful use of NIPPV in a patient who has not used it before is coaching, explaining the process, and reassuring the patient. Anxiety should be presumed due to hypoxia or inadequate minute ventilation and treated primarily with ventilatory support. Routine use of sedation is not recommended for treatment of anxiety in patients on NIPPV.
6. Once CPAP/BiPAP is initiated, breaking the mask seal may cause significant decrease in airway pressures and lead to abrupt decompensation due to atelectasis and alveolar collapse. Meticulous attention should be paid to maintaining mask seal unless hospital CPAP/BiPAP is immediately available for the patient to be switched over. In general, patients initiated on prehospital CPAP/BiPAP should remain on NIPPV. Discontinuation should only occur under the following settings:
    a. Patients who demonstrate significant improvement, discontinuation may occur under either physician consultation or an established process, or
    b. If the patient deteriorates on CPAP/BiPAP (e.g., worsened mental status, increasing $EtCO_2$, vomiting), discontinue CPAP/BiPAP and escalate airway management options as above.
7. ETI should only be used if less invasive methods do not meet patient care goals and should only be performed within EMS agencies with established educational programs and quality management systems that demonstrate continued proficiency.
8. Meticulous attention should be paid to avoiding hypoxemia and hypotension during intubation attempts to limit patient morbidity and mortality. This can only be achieved through proper pre-procedure preparation of the patient for optimal intubation.
9. Waveform capnography is the standard of care for invasive airway management and should be placed before the first breath through an invasive airway to confirm placement.
10. Drug assisted airway management (DAAM) may be required for patients with intact airway reflexes regardless of the etiology of their airway emergency. Complications of DAAM can directly contribute to a crisis of failed airway management and to poor patient outcomes. This component of invasive airway management should be restricted to EMS clinicians with appropriate education and credentialing and requires rigorous training, continuing education, quality assurance, and physician guidance to be successful.
11. Positive pressure ventilation can decrease preload and lead to hypotension; therefore, hyperventilation must be avoided. The clinician should anticipate this even with normal ventilation and be prepared to support BP.
12. Pediatric airway management requires appropriate tools and adjuncts based on patient size/age. A method for determining appropriate equipment sizing and ETI placement depth should be available to all EMS clinicians.
    a. Skill in BVM ventilation and NIPPV application should be emphasized in pediatrics.
    b. SGA are reasonable primary and secondary adjuncts if needed.
        1. Pediatric endotracheal intubation has unclear benefits in the prehospital setting.
        2. Pediatric endotracheal tube placement and maintenance require significant training to

achieve and maintain competency.

3. EMS Clinicians are less likely to attempt endotracheal intubation in children than adults with cardiac arrest and are more likely to be unsuccessful when intubating children. Complications such as malposition of the ETT or aspiration can be nearly three times as common in children as compared to adults.
4. Appropriate securing of the invasive airway and close monitoring for dislodgement is critical, especially the smaller the child.

Notes/Educational Pearls

<u>Key Considerations</u>

1. Signs of a difficult airway, including:
    a. short jaw or limited jaw thrust/mobility
    b. small thyromental space
    c. upper airway obstruction,
    d. large tongue
    e. large tonsils
    f. obesity
    g. large neck
    h. craniofacial abnormalities
    i. excessive facial hair
    j. tracheostomy scar or evidence of other neck/facial surgery
    k. trismus/limited mouth opening
    l. limited neck mobility
2. When evaluating for traumatic injuries impairing upper and lower airway anatomy and physiology, consider:
    a. Facial injuries,
    b. High spine injury (affecting phrenic nerve/intercostals),
    c. Neck injury (expanding hematoma, tracheal injury),
    d. Chest wall injury (bruising), including rib and sternal fracture, paradoxical chest motion, subcutaneous air, and sucking chest wound.
3. Oxygen is a medication with an appropriate dose range and undesirable effects from over and under supplementation. Effective oxygenation meets the oxygen saturation (SpO_2) target set for that specific patient in the context of their acute and chronic medical condition(s).
4. Passive administration of oxygen via nasal cannula in a patient with ineffective or absent ventilation, also known as apneic oxygenation, may reduce the risk of desaturation while preparing for more invasive airway maneuvers. This can be achieved by placing a nasal cannula at high flow rates.
5. For significantly contaminated airways, consider utilizing a suction assisted laryngeal airway decontamination (SALAD) technique.
6. Adequate ventilation provides sufficient minute ventilation to meet the patient's acute ventilatory and metabolic needs and is generally titrated to an $EtCO_2$ mmHg goal.
7. Permissive hypercapnia is an appropriate strategy in conditions such as severe bronchospasm.
8. Continuous waveform capnography is an important adjunct when monitoring patients with

respiratory distress, respiratory failure, and those treated with positive pressure ventilation. Continuous waveform capnography:

a. Should be used for patients with invasive airways for:
    i. Initial verification of correct airway placement
    ii. Continuous evidence of correct airway placement
    iii. Adjustments in ventilatory rate:
        1. To maintain $EtCO_2$ 35–45 mmHg in most patients.
        2. To appropriately but not excessively hyperventilate patients with signs of herniation only to maintain $EtCO_2$ 30–35 mmHg (no lower than 30 mmHg).
        3. To gradually decrease $EtCO_2$ in chronically and acutely severely hypercarbic patients, including post-arrest.
        4. To match initial compensatory ventilatory rate in patients with metabolic acidosis who undergo invasive airway management to avoid rapid physiologic deterioration from loss of compensatory tachypnea.
    iv. Monitoring during BVM ventilation.
b. Is strongly encouraged in patients in cardiac arrest:
    i. To monitor the quality of CPR.
    ii. As an early indicator of ROSC (rapid increase of at least 10 mmHg in $EtCO_2$).
    iii. To assist in evaluating prognosis for survival.
        1. Persistently low $EtCO_2$ (<10 mmHg) after adequate CPR for 20 minutes with invasive airway in place is likely an indication of poor prognosis.
c. Should be used in spontaneously breathing patients who are:
    i. On NIPPV.
    ii. In severe respiratory distress.
d. In spontaneously breathing patients, waveform capnography can help with assessment of critically ill patients, for example:
    i. Assessment of adequacy of ventilation and change in ventilatory status in response to treatment (e.g., post-ictal state).
    ii. Differentiating between severe bronchospasm (shark fin waveform) and other causes of respiratory distress with normal waveform (such as pulmonary edema).

9. General Bag-valve-mask (BVM) ventilation guidelines (for cardiac arrest patients, see Cardiac Arrest Guideline):
    a. Invasive airway management commonly begins with BVM ventilation. Proficiency in BVM ventilation is a critical component of expert airway management and a complex skill set. As a foundation of airway management, BVM ventilation can sustain or set the stage for success with subsequent steps in invasive airway management.
    b. A contoured mask should fit completely over the patient's nose and mouth (not eyes) and conform to the face, creating a good seal without air leaks. The mask should be sized so the apex (pointed end) seats over the bridge of the nose and the base (bottom) extends below the lower lip and seats in the cleft of the chin.
    c. Ventilations should be delivered with only sufficient volume to achieve chest rise. Overventilation is undesirable.
        i. In children, ventilating breaths should be delivered over one second, with a two-second pause between breaths.

   d. Ventilation rate: (see above)
10. Noninvasive positive pressure ventilation (NIPPV) (e.g., CPAP or BiPAP):
    a. Nebulized medications may be administered through a CPAP or BiPAP mask. A specialized T-connector with a spring valve assembly is required to allow maintenance of positive airway pressure.
11. Endotracheal intubation (ETI)
    a. Use of a checklist and protocolized interventions to optimize the patient physically and physiologically have been shown to improve success rates of ETI and decrease peri-intubation complications. Preparation should also include a promptly available plan for alternate airway placement if ETI is unsuccessful.
    b. A bougie may be a helpful adjunct to successful ETI placement, especially when the glottic opening is difficult to visualize with direct laryngoscopy.
    c. Placement in ear-to-sternal notch positioning can improve glottic visualization.
    d. Video laryngoscopy may enhance intubation success rates.
    e. Endotracheal tube sizes (cuffed tubes preferred in pediatrics)

Age	Size (mm) Uncuffed	Size (mm) Cuffed
Premature	2.5	
Term to 3 months	3.0	
3-7 months	3.5	3.0
7-15 months	4.0	3.5
15-24 months	4.5	3.5
2-15 years	[age(years)/4] + 4	[age(years)/4] + 3.5
Greater than 15 years		7.5 female/8.0 male

    f. Approximate depth of insertion = (3) x (endotracheal tube size)
    g. Routine use of cricoid pressure is not recommended in pediatric or adult intubation.
12. For patients being transferred from a hospital ventilator to a transport ventilator, the patient's current ventilator settings are generally a reasonable starting point if the patient is adequately oxygenated and ventilated based on pulse oximetry and capnography.

Pertinent Assessment Findings

1. Ongoing assessment during airway management is critical.
2. Acute worsening of respiratory status or evidence of hypoxemia can be secondary to displacement or obstruction of the airway device, pneumothorax, or equipment failure.

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01) *(for additional information, go to www.nemsis.org)*

- eAirway.01 Indications for Invasive Airway
- eAirway.ConformationGroup
- eAirway.08 Airway Complications Encountered
- eAirway.09 Suspected Reasons for Failed Airway Management
- eAirway.10 Date/Time Decision to Manage the Patient with an Invasive Airway

- eAirway.11 Date/Time Invasive Airway Placement Attempts Abandoned

Key Documentation Elements

- Initial vital signs and physical exam
- Interventions attempted including the method of airway intervention, the size of equipment used. Each discrete invasive airway attempt (to allow determination of success or failure on a per-attempt basis).
- Indications for invasive airway management.
- Subsequent vital signs and physical exam to assess for change after the interventions.
- Occurrence of peri-intubation hypoxia (less than 90% SPO_2), bradycardia (per age), hypotension (SBP less than 90mmHg or lowest age-appropriate SBP), or cardiac arrest. The peri-intubation period encompasses the time from sedative administration to up to 10 minutes post any invasive airway attempt.
- $EtCO_2$ value and capnograph, including immediately after invasive airway placement, with each patient movement (e.g., into and out of ambulance), and at the time of patient transfer in the ED.
- Recordings of video laryngoscopy may be useful for quality improvement purposes.

Performance Measures

- *National EMS Quality Alliance (NEMSQA) Performance Measures (for additional information, see www.nemsqa.org)*
    - *Respiratory—01: Respiratory Assessment*
    - Airway -01 Successful First Advanced Airway Placement without Hypotension or Hypoxia Measure Score Interpretation
    - Airway-05: Adequate Oxygen Saturation Achieved Before Intubation Procedure Measure Score Interpretation
    - Airway-07: $EtCO_2$ Verification of Advanced Airway Placement Measure Score Interpretation
    - Airway-10: Documentation of SPO2 Saturation with Advanced Airway Measure Score Interpretation

These NEMSQA Performance Measures are contemporaneous as of the publication of this guideline (May 5, 2023). As part of the larger guideline development process, NEMSQA is reviewing and updating airway management performance measures as needed, with an expected publication date of 1/5/2024. Additional information may be found at www.nemsqa.org.

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