This procedure includes the following:

- Endotracheal intubation (plus use of Supraglottic Airway Laryngopharyngeal Tube (S.A.L.T. device)), gum elastic bougie assisted tracheal intubation, video laryngoscopy)
- Non-Visualized Airways (Dual lumen airway, King LT-D™ Airway, Laryngeal Mask Airway (LMA))
- Cricothyroidotomy – needle and surgical

**GENERAL CONSIDERATIONS**

Rescuers must be aware of the risks and benefits of advanced airway management techniques. In cases of cardiac arrest, the insertion of an advanced airway may require interruption of chest compressions for many seconds, the rescuer should weigh the need for compressions against the need for insertion of an advanced airway. Rescuers may defer insertion of an advanced airway until the patient fails to respond to initial CPR and defibrillation attempts or demonstrates return of spontaneous circulation.

Providers should have a second (back-up) strategy for airway management and ventilation if they are unable to establish the first-choice airway adjunct. Bag-mask ventilation may provide that back-up strategy.

**ENDOTRACHEAL INTUBATION**

A. Indications for emergency endotracheal intubation are:
   1. Inability of the rescuer to adequately ventilate the patient with a bag-mask device
   2. The absence of airway protective reflexes (coma and cardiac arrest)

B. In most cases, endotracheal intubation provides definite control of the airway. Its purposes include:
   1. Actively ventilating the patient
   2. Delivering high concentrations of oxygen
   3. Suctioning secretions and maintaining airway patency
   4. Preventing aspiration of gastric content, upper airway secretions or blood
   5. Prevented gastric distention due to assisted ventilations
   6. Administering positive pressure when extra fluid is present in alveoli
   7. Administering medications during resuscitation for absorption through lungs as a last resort

C. Endotracheal intubation is an Advanced EMT and Paramedic skill. Per the State of Ohio Scope of Practice, Advanced EMTs are able to use endotracheal intubation for APNEIC patients only.

D. Hazards:
   1. Esophageal intubation
   2. Tracheal rupture
   3. Right mainstem bronchus intubation
   4. Broken teeth
   5. Laryngospasms
   6. Trauma to oropharynx
   7. Trauma or puncture of trachea due to misplacement of stylet
E. Technique

1. Always begin artificial ventilation as soon as possible using positive pressure ventilations. Deliver each breath over one second with sufficient volume to cause chest rise. Rescue breathing rate for adults is one breath every 5-6 seconds and one breath every 3-5 seconds for pediatrics and infants.

2. Assemble and prepare equipment

3. Check cuff on ET tube for leaks and lubricate tube. Introduce stylet and assure that the tip is at least ½” from the end of the tube.

4. **Tube Sizing** – the size of tube that can be passed easily into most adults is 8.0 mm (id). Therefore this tube should be tried first on the average adult. The size of the tube is judged by the size of the adult, not by age.

   **For children** a length-based tape (i.e., Broselow tape) can be used to determine proper size. Generally, the proper tube is usually equal to the size of the child’s little finger. The following guide will also help determining the proper sized tube:

   - Premature………3mm (id)  18-24 months….5-6mm (id)
   - 14-24 weeks……4mm (id)  2-4 years...........6mm (id)
   - 6-12 months……4-5mm (id)  4-7 years...........6-7mm (id)
   - 12-18 months….5mm (id)  7-10 years........7mm (id)

   All the above sizes are still dependent on the child’s size in consideration of age.

   Children younger than 8 years of age should have an uncuffed tube, or if the tube has a cuff, it should not be inflated after insertion.

5. Assemble laryngoscope and check bulb.

6. Put the victim’s head in sniffing position if cervical spine injuries are not suspected. Do not allow the head to hang over the end of the cot; the occiput of the head should be on the same horizontal plane as the back of the shoulders with the neck somewhat elevated.

7. Holding the laryngoscope in the left hand, insert the blade to the right of the midline, moving the tongue up and to the left, with the blade ending up in the midline, giving clear visualization of the glottic opening.

8. Remove dentures; suction the mouth and pharynx as necessary.

9. Visualize the epiglottis and identify the trachea, using the vocal cords and/or arytenoid cartilages as a guide.

10. Holding the ET tube in the right hand, insert the tube from the right side of the mouth, starting at the corner of the mouth down into the trachea. Advance tube so the cuff is 1 - 1 ½” beyond cords (or glottic marker is at the cords for pediatric tubes).

11. Remove laryngoscope and stylet (if used), holding the tube securely with the right hand.

12. If using an esophageal detector device to confirm endotracheal tube placement, this MUST be done prior to positive pressure ventilations.

13. Attempt to ventilate with bag-mask. Check for bilateral chest rise and auscultate for breath sounds over BOTH lung fields and for absence of sounds over epigastrium.

14. When placement confirmed, inflate cuff (for patients > 8 years of age) and secure the tube in place with oropharyngeal airway using a bite block.

15. Secondary tube placement confirmation is required and must be documented. This may be accomplished with an esophageal detector device (see number 12 above), end-tidal CO₂ detector or capnography.
16. Maintain ventilation until adequate respirations resume or the victim is transferred to the emergency department.

17. Recheck lung sounds and verify tube placement each time the patient is moved and every 10 minutes. Document these checks.

18. Document the intubation by noting the following:
   a. Number of attempts
   b. Person(s) making attempts
   c. Size of tube
   d. Type and size of laryngoscope blade
   e. Lung sounds before intubation
   f. Lung sounds after intubation and time of each check
   g. Secondary confirmation technique used
   h. Measurement on tube at lips of the patient when lung sounds are present
   i. Any complications

F. Using **Supraglottic Airway Laryngopharyngeal Tube (S.A.L.T.)** to assist with endotracheal intubation:
   1. Measure S.A.L.T. from the corner of the patient’s mouth to the tip of the ear.
   2. Use the epiglottic tongue blade (provided in the kit) to control the epiglottis
   3. Insert S.A.L.T. over the tongue blade (similar to inserting oropharyngeal airway over a tongue blade in a pediatric patient)
   4. Attach provided strap to maintain the airway. The patient can be ventilated with bag-mask at this time if needed.
   5. Pass the appropriate-sized ET tube (not provided in kit) through the S.A.L.T. into the trachea
   6. Verify placement. If using an esophageal detector device to confirm endotracheal tube placement, this MUST be done prior to positive pressure ventilations.
   7. Attempt to ventilate with bag-mask. Check for bilateral chest rise and auscultate for breath sounds over BOTH lung fields and for absence of sounds over epigastrium.
   8. When placement confirmed, inflate cuff (for patients > 8 years of age).
   10. Secondary tube placement confirmation is required and must be documented. This may be accomplished with an esophageal detector device, end-tidal CO₂ detector or capnography.

G. **Gum Elastic Bougie Assisted Tracheal Intubation**
   1. Can be used for the difficult orotracheal intubation.
   2. The bougie can accommodate ET tubes > 6mm (id)
   3. Perform direct laryngoscopy and maintain adequate laryngoscopic force to optimize the glottic view. Backwards pressure over the thyroid cartilage can also be employed to improve the view.
   4. Introduce the bougie into the patient’s mouth and gently advance it through the glottic opening (Grade II view) or anteriorly under the epiglottis (Grade III view) until clicks from the tracheal rings or hold up is felt.
   5. With the first rescuer still maintaining laryngoscopic force, a 2nd rescuer then threads a tracheal tube over the bougie and advances it to a depth of 20-24 cm while maintaining proximal control over the 60 cm long bougie. Occasionally, the bougie and tracheal tube may need to be rotated 90° for the tube to pass.
6. Verify placement. If using an esophageal detector device to confirm endotracheal tube placement, this MUST be done prior to positive pressure ventilations.
7. Attempt to ventilate with bag-mask. Check for bilateral chest rise and auscultate for breath sounds over BOTH lung fields and for absence of sounds over epigastrum.
8. Secondary tube placement confirmation is required and must be documented. This may be accomplished with an esophageal detector device, end-tidal CO$_2$ detector or capnography.

H. **Video Laryngoscopy** - follow specific manufacturer’s recommendations

I. **Tube Removal** – if the patient begins to breathe spontaneously and effectively and is resisting the presence of the tube, removal of the tube may be necessary. The following procedure will be followed:
   1. Explain procedure to patient
   2. Prepare suction equipment and suction secretions form ET tube, mouth and pharynx
   3. The lungs should be completely inflated so that the patient will initially cough or exhale as the tube is taken from the larynx. This can be accomplished in two ways:
      a. The patient is asked to take the deepest breath they possibly can and, at the very peak of the inspiratory effort, the cuff is deflated and the tube rapidly removed; or
      b. Positive pressure ventilation is administered with bag-mask and, at the end of deep inspiration, the cuff is deflated and the tube rapidly removed.
   4. Prepare to suction secretions and gastric contents if vomiting occurs,
   5. Apply pulse oximeter and administer oxygen via NC or NRB as indicated.
   6. The patient’s airway is immediately evaluated for signs of obstruction, stridor, or difficulty breathing. The patient should be encouraged to take deep breaths and to cough.
   7. The patient is not to be left unattended until there is no doubt of their ability to function without the artificial airway.

**NON-VISUALIZED AIRWAYS**

A. Indications:
   1. Basic EMT: Advanced airway management option for apneic and pulseless patients.
   2. Advanced EMT: Alternative for a definitive airway with a difficult airway and/or failed intubation for apneic patients.
   3. Paramedic: Alternative for definitive airway with a difficult airway and/or failed intubation.

B. Device options:
   1. Dual lumen airway (Combitube®)
   2. King LT-D™ Airway
   3. Laryngeal Mask Airway (LMA) *** iGel Addendum Protocol ***

C. Contraindications:
   1. Patient has a gag reflex
   2. Appropriate sized airway is unavailable.
   3. In cases of known esophageal disease or cirrhosis, history of esophageal injury or trauma
   4. In cases of caustic poison ingestion
   5. Foreign body in trachea
   6. Tracheostomy or laryngectomy
5. Foreign body in trachea
6. Tracheostomy or laryngectomy
7. Respiratory depression / arrest due to suspected narcotic overdose or hypoglycemia prior to administration of Narcan and/or glucose.

D. Dual Lumen Airway (Combitube®)
1. Always begin artificial ventilation immediately using an oral or nasal airway and positive pressure ventilations.
2. Remove dentures; suction secretions from mouth and oropharynx
3. Select appropriate sized tube
   a. 41F Combitube® for patients 5 feet tall and greater
   b. 37F Combitube SA® for patients between 4 and 5 ½ feet tall
4. Prior to insertion, test cuff integrity with the prescribed volume of air.
5. Tip for successful tube insertion: Gently bend the distal end of the tube (“Lipp Maneuver”) before insertion
6. Lubricate tube with water soluble lubricant to facilitate insertion
7. Hyperoxygenate the patient with several ventilations
8. To direct stomach contents away from personnel, attach the fluid deflector elbow to the clear connecting lumen marked No. 2
9. With the patient in the supine position, the patient’s head should be in neutral of slightly elevated position unless contraindicated due to suspected cervical spine injury.
10. Lift the tongue and jaw upward with one hand
11. With the other hand, hold the Combitube® so that is curves in the same direction as the natural curvature of the pharynx. Maintain a mid-line position of the tube. Insert the tip into the mouth, advance along the tongue in a downward curved movement until the teeth or alveolar ridges lie between the two printed bands on the tube.
   DO NOT FORCE the Combitube®. If the tube does not advance easily, redirect it or withdraw and attempt one more insertion. If unsuccessful after the second attempt, continue ventilation with oral airway and positive pressure ventilations.
12. Inflate #1 blue pilot balloon. The large cuff will fill and may cause the tube to slightly move. This is to be expected. Additional air may be added to the cuff if inadequate seal is detected during ventilation.
13. Inflate #2 white balloon.
14. Begin ventilation through the longer connecting tube labeled No.1. If auscultation of breath sounds is positive and no sounds are auscultated over epigastric area, continue ventilation. Under this condition, the second connecting tube may be used for the removal of gastric fluids with the suction catheter.
15. If auscultation of breath sounds is negative and sounds are heard over the epigastric area, immediately begin ventilation through the shorter clear connecting tube labeled No. 2. Confirm tracheal ventilation by auscultation of breath sounds and absence of epigastric sounds. In rare cases, if ventilation does not function in either the esophageal or tracheal lumen, deflate both balloons, remove the tube and ventilate patient with positive pressure ventilations.
16. Secure tube with appropriate securing device.
17. Monitor pulse oximetry, end-tidal CO₂ and/or capnography.
18. Document the procedure by noting the following:
   a. Number of attempts
   b. Person(s) making attempts
c. Time of insertion
d. Presence of lung sounds, absence of epigastric sounds, and chest rise and fall immediately after insertion and minimally every 10 minutes or after each significant movement of the patient.
e. Which port – longer blue or shorter clear – is used for ventilations
f. SpO₂ / end-tidal CO₂ / capnography reading every 10 minutes.
g. Any complications.

19. **Removal of Combitube®**. If the patient begins to breathe spontaneously and effectively and is resisting the presence of the Combitube®, removal of the airway is necessary.
   a. If the Combitube® is in the esophageal position, the clear tube should be used to suction gastric contents prior to tube removal
   b. Turn the patient on his/her side
   c. Have suction equipment ready with large-bore suction catheter
d. Deflate pharyngeal cuff (blue pilot balloon); attempt endotracheal intubation at this time, if applicable
e. Deflate the distal cuff (white pilot balloon) and remove the airway.
f. Suction any emesis. A significant number of patients will vomit at this point

E. **King LT-D™**
   1. Always begin artificial ventilation immediately using an oral or nasal airway and positive pressure ventilations.
   2. Remove dentures; suction secretions from mouth and oropharynx
3. Select appropriate sized tube and test cuff inflation by injecting the maximum recommended volume of air (listed in table below) into the cuffs. Remove all air prior to insertion.

<table>
<thead>
<tr>
<th>Size</th>
<th>Patient description</th>
<th>Connector Color</th>
<th>Inflation Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>35 – 45 inches tall</td>
<td>Green</td>
<td>25-35 ml</td>
</tr>
<tr>
<td>2.5</td>
<td>41 – 51 inches</td>
<td>Orange</td>
<td>30-40 ml</td>
</tr>
<tr>
<td>3</td>
<td>4 – 5 feet tall</td>
<td>Yellow</td>
<td>45-60 ml</td>
</tr>
<tr>
<td>4</td>
<td>5 – 6 feet tall</td>
<td>Red</td>
<td>60-80 ml</td>
</tr>
<tr>
<td>5</td>
<td>Greater than 6 feet tall</td>
<td>Purple</td>
<td>70-90ml</td>
</tr>
</tbody>
</table>

4. Apply water-based lubricant to beveled distal tip and posterior aspect of the tube, taking care to avoid introduction of lubricant in or near the ventilator openings.

5. Position the patient's head. The ideal position is the "sniffing position". If this is contraindicated due to suspected spinal injury, the tube can be inserted with the head in a neutral position.

6. Hold the tube at the connector end with the dominant hand. With the non-dominant hand, hold mouth open and apply chin lift.

7. With the tube rotated laterally 45-90° such that the blue orientation line is touching the corner of the mouth, introduce tip into mouth and advance behind the base of tongue.

8. As tube passes under the tongue, rotate tube back to midline (blue orientation line faces chin).

NOTE: Key to insertion is to get the distal tip of tube around the corner in the posterior pharynx, under the base of the tongue. Use of the lateral approach in conjunction with a chin lift will facilitate tube placement.
9. Without exerting excessive force, advance tube until base of connector is aligned with the teeth or gums.
10. Inflate cuffs with the minimum volume necessary to seal the airway at peak ventilator pressure employed (just seal volume).
11. Attach BVM to tube connector. While gently bagging the patient to assess ventilation, simultaneously and slowly withdraw the tube until ventilation is easy and free-flowing (large tidal volume with minimal airway pressure).
12. Confirm tube placement by auscultation of lung sounds, chest rise, verification of CO₂ by end tidal CO₂ or capnography. Secure tube with appropriate securing device.
13. Adjust cuff inflation, if necessary, to obtain an airway seal at peak ventilation pressure.

14. Document the procedure by noting the following:
   a. Number of attempts
   b. Person(s) making attempts
   c. Presence of lung sounds, absence of epigastric sounds, and chest rise and fall immediately after insertion and minimally every 10 minutes or after each significant movement of the patient.
   d. SpO₂ / end-tidal CO₂ / capnography reading every 10 minutes.
   e. Any complications.

15. **King LT-D™ Removal:**
   a. Once it is in the correct position, the King LT-D Airway is well tolerated until the return of protective reflexes.
   b. Suction oral cavity above the cuff.
   c. Fully deflate the cuffs and remove the tube.

### F. Laryngeal Mask Airway (LMA)™

1. Always begin artificial ventilation immediately using an oral or nasal airway and positive pressure ventilations.
2. Remove dentures; suction secretions from mouth and oropharynx
3. Select appropriate sized tube.

<table>
<thead>
<tr>
<th>LMA™ Size</th>
<th>Patient Description</th>
<th>Maximum Inflation Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Neonates/Infants up to 5 kg</td>
<td>4 ml</td>
</tr>
<tr>
<td>1 ½</td>
<td>Infants 5-10 kg</td>
<td>7 ml</td>
</tr>
<tr>
<td>2</td>
<td>Infants/Children 10-20 kg</td>
<td>10 ml</td>
</tr>
<tr>
<td>2 ½</td>
<td>Children 20-30 kg</td>
<td>14 ml</td>
</tr>
<tr>
<td>3</td>
<td>Children 30-50 kg</td>
<td>20 ml</td>
</tr>
<tr>
<td>4</td>
<td>Adult 50-70 kg</td>
<td>30 ml</td>
</tr>
<tr>
<td>5</td>
<td>Adult 70-100 kg</td>
<td>40 ml</td>
</tr>
<tr>
<td>6</td>
<td>Adult &gt; 100 kg</td>
<td>50 ml</td>
</tr>
</tbody>
</table>
4. Prior to insertion of the LMA™ airway, the cuff should be tightly deflated so that it forms a smooth “spoon-shape” without any wrinkles on the distal edge. Press the mask with its aperture side down on a flat surface with the fingers being used to guide the cuff into the desired shape.

5. In order to ensure airway is completely deflated, the “flip-test” should be performed. When the tip of the deflated cuff is inverted, it should flip back to its original position. If it does not, there may be air inside the cuff or the mask may be incorrectly deflated.


7. Position the patient’s head. The ideal position is the “sniffing position”. If this is contraindicated due to suspected spinal injury, the tube can be inserted with the head in a neutral position.

8. Hold LMA™ airway like a pen, with the index finger placed at the junction of the cuff and the tube. Mask aperture must face posteriorly and the black line on the airway tube should be oriented anteriorly toward the upper lip.

9. Press the tip of the cuff upward against the hard palate and flatten the cuff against it.

10. Using the index finger to guide the LMA™ airway, press backwards toward the ears in one smooth movement. Do NOT use force. Advance LMA™ into hypopharynx until a definite resistance is felt.

11. Check to ensure that the black line is oriented anteriorly toward the upper lip.

12. Inflate the cuff with just enough pressure to obtain a seal. The airway may move during inflation. Do NOT overinflate.

13. Signs of correct placement may include one or more of the following: the slight outward movement of the LMA™ airway with inflation, presence of a smooth oval swelling in the neck around the thyroid and cricoid area, or no cuff visible in the oral cavity.
14. Confirm tube placement by auscultation of lung sounds, chest rise, verification of CO₂ by end tidal CO₂ or capnography. Secure tube with appropriate securing device.

15. Document the procedure by noting the following:
   a. Number of attempts
   b. Person(s) making attempts
   c. Presence of lung sounds, absence of epigastric sounds, and chest rise and fall immediately after insertion and minimally every 10 minutes or after each significant movement of the patient.
   d. SpO₂ / end-tidal CO₂ / capnography reading every 10 minutes.
   e. Any complications.

**CRICOTHYROIDOTOMY**

A. Indications – unable to manage airway by other methods. This may be seen with:
   1. Cervical spine injuries
   2. Maxillofacial trauma
   3. Laryngeal trauma
   4. Oropharyngeal obstruction from:
      a. Edema due to infection, caustic ingestion, allergic reaction, and/or inhalation injuries
      b. Foreign body
      c. Mass lesion
   5. All other advanced airway management options are contraindicated

B. Complications:
   1. Hemorrhage or hematoma formation
   2. Aspiration
   3. Creation of false passage into the tissues
   4. Subglottic stenosis/edema
   5. Laryngeal stenosis
   6. Laceration of esophagus or trachea
   7. Vocal cord paralysis / voice change

C. Needle Cricothyroidotomy
   1. Place patient in supine position
   2. Prep area with antiseptic solution
   3. Attach a 12-14 gauge, 8.5 cm, over-the-needle catheter to 5-10 ml syringe
   4. Palpate cricothyroid membrane, anteriorly, between the thyroid and cricoid cartilages.
   5. Stabilize the trachea with the thumb and forefinger of one hand to prevent lateral movement of the trachea.
   6. Insert the needle into the cricothyroid membrane at 45° angle caudally, while applying negative pressure with the syringe.
7. Aspiration of air signifies entry into the tracheal lumen.
8. Advance the catheter downward and remove the needle and syringe.

9. Intermittent positive pressure ventilations can now be provided with jet ventilator or place the connector from a size 3 ET tube on the catheter and ventilate with BVM.
10. Continue to observe lung inflations and auscultate the chest for adequate ventilation.

D. Surgical Cricothyroidotomy – manufactured cricothyroidotomy kits are preferred. Follow manufacturer's recommendations for technique. For manual surgical cricothyrotomy:
1. Place patient in supine position with neck in neutral position.
2. Palpate thyroid notch, cricothyroid interval, and sternal notch for orientation.
3. Prep area with antiseptic solution.
4. Stabilize thyroid cartilage with one hand and maintain stabilization until trachea is intubated.
5. Make transverse skin incision over the cricothyroid membrane, and carefully incise through membrane transversely.
6. Insert scalpel handle into the incision and rotate it 90° to open the airway. A hemostat or tracheal spreader also may be used instead of the scalpel handle.
7. Insert appropriately sized, cuffed endotracheal tube into the incision, directing the tube distally into the trachea.
8. Inflate the cuff and ventilate the patient.
9. Observe lung inflation and auscultate the chest for adequate ventilation.
10. Secure the tube.
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