Case History

Your EMS system allows EMT-Basics to intubate. You respond to a 42-year-old woman in cardiopulmonary arrest. You attach the AED and shock the patient three times without successful conversion and start CPR.

Responsibilities

- EMTs who intubate have a responsibility to achieve and maintain skill.
  - Preparation
  - Practice
  - Reinforcement
  - Continued evaluation
Important to Remember

- Advanced and alternate airway skills do not stand alone as patient management tools. They are integrated with other basic airway management techniques.
  - Manually opening the airway
  - Suctioning
  - Airway adjuncts

Sellick Maneuver – Purpose

- For use in unresponsive patients without a cough or gag reflex
- Prevents regurgitation and aspiration
- Used during endotracheal intubation

Sellick Maneuver
Cricoid Cartilage – Anatomic Location

- Circumferentially cartilaginous
- Cricoid cartilage is inferior to the cricothyroid membrane:
  - Palpate depression below thyroid cartilage (Adam's apple)
Sellick Maneuver – Special Considerations

- Verify correct anatomy to avoid damage to other structures.
- Difficult to locate in the child and small adult.
- Excessive pressure may cause tracheal obstruction.
- Use only when sufficient personnel are available.

Orotracheal Intubation

Purpose

- Most effective means of controlling airway
  - Complete control of the airway
  - Minimizes risk of aspiration
  - Allows for better oxygen delivery
  - Allows for deeper suctioning
**Orotracheal Intubation – Indications**

- When adequate artificial ventilation cannot be achieved by other methods
- Patient who is unresponsive to painful stimuli
- Patient with no gag reflex or coughing
- Inability of the patient to protect his or her own airway
- When prolonged artificial ventilation is required

**Orotracheal Intubation – Complications**

- Esophageal intubation
- Inadequate ventilation and oxygenation
- Soft tissue trauma
- Right mainstem bronchus intubation
- Vomiting
- Bradycardia and dysrhythmias
- Self-extubation
- Tube dislodgement

**Personal Protective Equipment**

- Gloves
- Mask
- Goggles
**Equipment – Laryngoscope**
- Handle
- Blade
  - Straight (Miller)
  - Curved (Macintosh)
- Light
- Batteries

**Straight Blade**
- Straight blade is preferred in infants
  - Provides greater displacement of the tongue
  - Provides better visualization of the glottis
- Assorted sizes – 0-4
- Lifts the epiglottis to allow visualization

**Straight Blade Position**
Curved Blade

- Preferred in adults and older children
- Broader base and flange provide displacement of the tongue.
- Assorted sizes – 0-4
- Inserted into the vallecula to allow visualization

Curved Blade Position

Equipment – Endotracheal Tubes

- Vary in size (2.5 to 10.0 mm)
  - Average adult
    - Female: 7.0 mm
    - Male: 8.0 to 8.5 mm
- Helpful to have one tube larger and one tube smaller than estimated available
### Equipment – Stylet

- Malleable metal tube
- Inserted into endotracheal tube to provide stiffness and shape
  - Hockey stick formation facilitates tube insertion
- Lubricate for easy removal.
- Insert no further than ¼” from Murphy’s eye.

### Equipment – Water-Soluble Lubricant

- Applied to the cuffed end of endotracheal tube
  - For ease of insertion
- Applied to stylet
  - For ease of removal

### Other Equipment

- Syringe
  - 10 ml
- Securing device
- Suction
- Towels
Orotracheal Intubation

Procedure

Preventilate the Patient

Procedure – Assemble and Test Equipment

- Laryngoscope
  - Lock blade onto bar.

- Check light
  - Should be a "bright, white, steady, light light"
  - Spare bulbs should be available.
Procedure – Assemble and Test Equipment

- Endotracheal tube
  - Check cuff for leaks.
  - Deflate cuff after checking it.

Procedure – Align Head to Ensure Visualization

Procedure – Insert Blade
Procedure – Visualize Glottic Opening
- Sellick maneuver may be beneficial.

Procedure – Insert and Inflate Endotracheal Tube

Procedure – Auscultate
- Begin over epigastrium.
  - No sounds should be heard during artificial ventilation.
- Listen at the apex and base of the lungs.
  - Compare left and right.
  - Breath sounds should be equal bilaterally.
Procedure —
Confirm Placement with Secondary Device

Procedure (Continued)

- Secure tube.
- Ventilate at an age-appropriate rate.
- Note the distance that the tube has been inserted.
- An oral airway may be inserted to act as a bite block.

Alternative Airway Devices

- Esophageal-tracheal combitube (ETC)
- Pharyngotracheal lumen airway (PTL)
- Laryngeal mask airway (LMA)
ETC and PTL

- Look similar to endotracheal tube but have two lumens
- May be inserted into esophagus or trachea
- Blind insertion

ETC and PTL – Complications

- Most significant complication – ventilation through wrong port
  - Check for primary placement.
  - Obtain secondary confirmation.
- May cause damage to esophageal wall
  - Rare

ETC and PTL – Contraindications

- Do not use in patients:
  - <5 feet tall
  - <14 years old
  - With history of caustic ingestion
  - With history of esophageal disease
  - With an active gag reflex
- Remove if patient becomes conscious.
ETC and PTL – Equipment

- PPE (gloves, eyewear, mask)
- Stethoscope
- Suction
- End-tidal carbon dioxide monitoring device
- Water-soluble lubricant
- Two syringes to inflate pharyngeal and distal cuffs
- Oxygen
- Securing device

Procedure – Insertion of ETC

- Hyperventilate for 30 seconds.
- Place head in neutral position.
- Insert ETC following natural curvature of pharynx until teeth are between black rings.
- Inflate pharyngeal cuff.
- Inflate distal cuff.

Procedure – Insertion of ETC

- Confirm place through auscultation:
  - If esophageal placement, continue to ventilate through blue tube.
  - If tracheal placement, ventilate through clear tube.
- Confirm with end-tidal CO₂ detector.
Laryngeal Mask Airway

- Used by anesthesiology for several years.
- Increased use in emergency medicine (25%)
- Inserted into airway until tip rests at upper end of the esophagus
- Seals around glottis

LMA

- Inserted blindly
- May not protect against aspiration.
- Equivalent in some studies to endotracheal intubation
- Superior to bag-valve-mask for BLS providers in preventing regurgitation
LMA – Equipment

- PPE (gloves, eyewear, mask)
- Stethoscope
- Suction
- End-tidal carbon dioxide monitoring device
- Water-soluble lubricant
- Syringe to inflate mask
- Oxygen
- Securing device

Procedure – Insertion of the LMA

- Tightly deflate the cuff so that it forms a smooth “spoon shape.”

- Lubricate the posterior surface of the mask with water-soluble lubricant.

- Hold the LMA like a pen, with the index finger placed at the junction of the cuff and the tube.

- With the head extended and the neck flexed, carefully flatten the LMA tip against the hard palate.

- Use the index finger to push cranially, maintaining pressure on the tube with the finger.

- Advance the mask until definite resistance is felt at the base of the hypopharynx.
Procedure – Insertion of the LMA

- Gently maintain cranial pressure with the nondominant hand while removing the index finger.
- Without holding the tube, inflate the cuff with just enough air to obtain a seal.
- Auscultate breath sounds.
- Check with end-tidal CO₂ detector.

Orotracheal Suctioning – Indications

- Obvious secretions
- Poor compliance with the bag-valve-mask
- Gurgling sounds during ventilations

Orotracheal Suctioning – Complications

- Dysrhythmias
- Hypoxia
- Coughing
- Mucosal damage
- Bronchospasms
Procedure — Orotracheal Suctioning

- Preventilate

Procedure — Orotracheal Suctioning

- Insert catheter and suction.

Procedure — Orotracheal Suctioning

- After suctioning, hyperoxygenate.
Advanced Airway Management – Infants and Children

Anatomic and Physiologic Considerations

- **Mouth and nose**
  - Smaller structures
  - More easily obstructed than in adults

- **Pharynx**
  - Tongue takes up proportionally more space in the mouth.

- **Trachea (windpipe)**
  - Narrower
  - Less flexible

- **Trachea (windpipe)**
  - Narrower in children
  - Can be obstructed more easily by swelling

- **Cricoid cartilage**
  - Less developed and less rigid

- **Diaphragm**
  - Chest wall is softer and children tend to depend more heavily on the diaphragm for breathing.
Special Considerations

- Difficult to create a single, clear visual plane
  - From the mouth through the pharynx to the larynx

- Cricoid ring is the narrowest part of the child’s airway
  - ET sizing based on the size of the cricoid ring rather than the glottic opening
  - Cricoid ring serves as “physiologic” cuff

Infant and Child Endotracheal Tubes

- Uncuffed tubes for <8 years old
  - The circular narrowing at the level of the cricoid cartilage serves as cuff

- Cuffed tubes for children >8 years old

- Should have a vocal cord marker to ensure that the tip of the tube is placed in a midtracheal position

Infant and Child Endotracheal Tubes

- Best to have a chart or tape device to assist in sizing
- Infants and children
  - 3.0-3.5 for newborns and small infants
  - 4.0 up to 1 year old
- Formula
  - 16 + age in years divided by 4
- Alternate sizing
  - Size of little finger
  - Nasal sizing
Helpful Hints

Table 34-1 Distance from Teeth to Mid-Trachea

<table>
<thead>
<tr>
<th>Age</th>
<th>Distance from Teeth to Mid-trachea (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 mo to 1 yr</td>
<td>12</td>
</tr>
<tr>
<td>2 yr</td>
<td>14</td>
</tr>
<tr>
<td>4-6 yr</td>
<td>16</td>
</tr>
<tr>
<td>6-10 yr</td>
<td>18</td>
</tr>
<tr>
<td>10-12 yr</td>
<td>20</td>
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</tbody>
</table>

Suction Unit

- Readily available in case of emesis
- Large-bore catheter is needed to suction during intubation
- French catheter can be used for endotracheal suctioning
- Towels
  - Helpful to raise the patient's shoulders or occiput to align the airway

Procedure – Intubation: Infants and Children

- Don PPE.
- Ensure adequate artificial ventilations by bag-valve-mask and oxygen
  - Hyperventilate at an age-appropriate rate before any intubation attempt
- Assemble and test all equipment
Preventilate

Mechanical stimulation of the airway may cause a slowing of the heart rate.

If a slow heart rate is noted, interrupt intubation to reventilate the infant or child.

Monitor Heart Rate

- Mechanical stimulation of the airway may cause a slowing of the heart rate.
- If a slow heart rate is noted, interrupt intubation to reventilate the infant or child.

Head Alignment

- Unless trauma is suspected:
  - Tilt the head.
  - Lift the chin.
  - Attempt to visualize the cords.
- If unable to visualize the cords:
  - Raise shoulder 2 inch or more (based on age).
  - Attempt visualization again.
- If trauma is suspected, intubate with head and neck in a neutral position using inline stabilization.
Procedure – Blade Insertion

- Curved – into vallecula
- Straight — Lifts epiglottis
  - Epiglottis is made of cartilage, which is less developed than an adult.
  - More likely to block the airway
  - Will require more attention in order to visualize the airway
  - Lift up and away from the patient.
- Use great care to avoid using the teeth as a fulcrum.

Visualize Glottic Opening
Procedure — Insert ET and Auscultate

Confirmation of Placement

- Assess for symmetric rise and fall of the chest.
  - Best indicator, as breath sounds may be misleading in this population
- Assess for an improvement in heart rate and skin color.

Auscultate Breath Sounds

- Begin over epigastrium.
  - Insufflation or gurgling sounds should be absent.
- Listen to the left apex and base; compare with right apex and base.
  - Breath sounds should be equal bilaterally.
- Listen at the sternal notch.
Position of Tube

- Secure tube.
  - If breath sounds are bilaterally equal
  - If no sounds are heard in the epigastrium
- Inflate the cuff.
- After securing tube, reconfirm tube placement.

Secondary Confirmation

After Successful Intubation

- Ventilate at an age-appropriate rate.
- Note the distance that the tube has been inserted.
- An oral airway may be inserted to act as a bite block.