Chapter 6
Airway Management
U.S. DOT Objectives Directory

U.S. DOT Objectives are covered and/or supported by the PowerPoint™ Slide Program and Notes for Emergency Care, 11th Ed. Please see the Chapter 6 correlation below.

*KNOWLEDGE AND ATTITUDE*

- **2-1.1** Name and label the major structures of the respiratory system on a diagram. Slides 7-11
- **2-1.2** List the signs of adequate breathing. Slides 14-17
- **2-1.3** List the signs of inadequate breathing. Slides 14, 18-24, 26
- **2-1.4** Describe the steps in performing the head-tilt, chin-lift. Slide 29
- **2-1.5** Relate mechanism of injury to opening the airway. Slide 30
- **2-1.6** Describe the steps in performing the jaw-thrust. Slide 30
- **2-1.7** State the importance of having a suction unit ready for immediate use when providing emergency care. Slide 65
- **2-1.8** Describe the techniques of suctioning. Slides 64-70
- **2-1.9** Describe how to artificially ventilate a patient with a pocket mask. Slides 33, 35, 39-40, 43-45

(cont.)
*KNOWLEDGE AND ATTITUDE

- **2-1.10** Describe the steps in performing the skill of artificially ventilating a patient with a bag-valve mask while using the jaw-thrust. Slides 35, 41-45
- **2-1.11** List the parts of a bag-valve-mask system. Slides 34, 37
- **2-1.12** Describe the steps in performing the skill of artificially ventilating a patient with a bag-valve mask for one and two rescuers. Slide 38
- **2-1.13** Describe the signs of adequate artificial ventilation using the bag-valve mask. Slides 43-45
- **2-1.14** Describe the signs of inadequate artificial ventilation using the bag-valve mask. Slides 43-45
- **2-1.15** Describe the steps in artificially ventilating a patient with a flow-restricted, oxygen-powered ventilation device. Slides 36, 50-54
- **2-1.16** List the steps in performing the actions taken when providing mouth-to-mouth and mouth-to-stoma artificial ventilation. Slides 46-49
- **2-1.17** Describe how to measure and insert an oropharyngeal (oral) airway. Slides 58-61
- **2-1.18** Describe how to measure and insert a nasopharyngeal (nasal) airway. Slides 62-63

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*KNOWLEDGE AND ATTITUDE

- 2-1.19 Define the components of an oxygen delivery system. Slides 71-79
- 2-1.20 Identify a nonrebreather face mask and state the oxygen flow requirements needed for its use. Slides 80-82, 85
- 2-1.21 Describe the indications for using a nasal cannula versus a nonrebreather face mask. Slide 83
- 2-1.22 Identify a nasal cannula and state the flow requirements needed for its use. Slides 84-85
- 2-1.23 Explain the rationale for basic life support artificial ventilation and airway protective skills taking priority over most other basic life support skills.
- 2-1.24 Explain the rationale for providing adequate oxygenation through high inspired oxygen concentrations to patients who, in the past, may have received low concentrations.

(cont.)
*SKILLS

- 2-1.25 Demonstrate the steps in performing the head-tilt, chin-lift.
- 2-1.26 Demonstrate the steps in performing the jaw-thrust.
- 2-1.27 Demonstrate the techniques of suctioning.
- 2-1.28 Demonstrate the steps in providing mouth-to-mouth artificial ventilation with body substance isolation (barrier shields).
- 2-1.29 Demonstrate how to use a pocket mask to artificially ventilate a patient.
- 2-1.30 Demonstrate the assembly of a bag-valve-mask unit.
- 2-1.31 Demonstrate the steps in performing the skill of artificially ventilating a patient with a bag-valve mask for one and two rescuers.
- 2-1.32 Demonstrate the steps in performing the skill of artificially ventilating a patient with a bag-valve mask while using the jaw thrust.
- 2-1.33 Demonstrate artificial ventilation of a patient with a flow-restricted, oxygen-powered ventilation device.
- 2-1.34 Demonstrate how to artificially ventilate a patient with a stoma.
- 2-1.35 Demonstrate how to insert an oropharyngeal (oral) airway.
- 2-1.36 Demonstrate how to insert a nasopharyngeal (nasal) airway.
- 2-1.37 Demonstrate the correct operation of oxygen tanks and regulators.

(cont.)
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*SILLS*

- **2-1.38** Demonstrate the use of a nonrebreather face mask and state the oxygen flow requirements needed for its use.
- **2-1.39** Demonstrate the use of a nasal cannula and state the flow requirements for its use.
- **2-1.40** Demonstrate how to artificially ventilate the infant and child patient.
- **2-1.41** Demonstrate oxygen administration for the infant and child patient.
Virtual Tours

Click [here](#) to view a virtual tour of the airway.
Review of the Respiratory System
Upper Airway:
Respiratory System

Nasal cavity

Hard palate
Soft palate
Tonsil

OROPHARYNX

Tongue
Vallecula

LARYNGOPHARYNX

Epiglottis
Vocal cords

LARYNX

Esophagus

Mandible
Hyoid bone
Thyroid cartilage (Adam’s Apple)
Trachea
Cricoid cartilage
Thyroid gland
Lower Airway: Respiratory System
Lungs: Respiratory System

- **Lungs**
  - Right lung larger than the left lung

- **Covered by pleura**
  - Visceral pleura (inner most lining)
  - Parietal pleura (outer most lining)
Gas Exchange: Respiratory System

(a) Pulmonary arteriole
   Lung alveolus
   Pulmonary venule

(b) Tissue cells
   Artery
   Arteriole
   Capillaries
   Vein
The Respiratory System’s Main Function: Ventilation

Exhalation
Inhalation
Respiratory Assessment Determination

Adequate Breathing? or Inadequate Breathing?
Signs of Adequate Breathing

✿ **Look:**
  - For adequate and equal expansion of both sides of the chest when the patient inhales

✿ **Listen:**
  - For air entering and leaving the nose, mouth, and chest

✿ **Feel:**
  - For air moving out of the nose or mouth.
Adequate Breathing

Normal Rates

* Adults
  – 12–20 breaths/min.

* Children
  – 15–30 breaths/min.

* Infant
  – 25–50 breaths/min.

(cont.)
Adequate Breathing

- **Rhythm**
  - Usually regular

- **Quality**
  - Breath sounds present and equal
  - Minimal effort

- **Depth**
  - Chest expands adequately and equally
Hypoxia

- Inadequate amount of oxygen being delivered to the cells, resulting in an oxygen deficiency
Inadequate Breathing
Inadequate Breathing

- Mild/moderate hypoxia
  - Tachypnea
  - Dyspnea
  - Tachycardia
  - Pale, cool skin
  - Hypertension
  - Restlessness
  - Disorientation
  - Headache

(cont.)
Inadequate Breathing

* Severe hypoxia
  – Tachypnea
  – Dyspnea
  – Tachycardia (early), then bradycardia
  – Pale, cool skin
  – Hypertension
  – Drowsiness
  – Confusion
  – Altered mental status
  – Accessory muscle use

(cont.)
Inadequate Breathing

Critical Findings

- Respiratory failure
  - Oxygen intake not enough to support life
- Respiratory arrest
  - Breathing stops completely.
Inadequate Breathing

- **Rate**
  - Outside normal range (fast or slow)

- **Rhythm**
  - Regular or irregular

- **Depth**
  - Chest expansion shallow

(cont.)
Inadequate Breathing

**Quality**
- Abnormal breath sounds (noisy, diminished, or absent)
- Chest expansion unequal
- Increased breathing effort

**Skin**
- Pale, cyanotic, cool, or clammy
**Child vs. Adult Airway**

<table>
<thead>
<tr>
<th>Child has smaller nose and mouth.</th>
</tr>
</thead>
<tbody>
<tr>
<td>In child, more space is taken up by tongue.</td>
</tr>
<tr>
<td>Child’s trachea is narrower.</td>
</tr>
<tr>
<td>Cricoid cartilage is less rigid and less developed.</td>
</tr>
<tr>
<td>Airway structures are more easily obstructed.</td>
</tr>
</tbody>
</table>
Inadequate Breathing

- Infants and children
  - Nasal flaring
  - See-saw breathing
  - Retractions
Opening the Airway

Goal is to establish and maintain a patent (clear and open) airway!
Neutral Alignment: Pediatric
Head-Tilt, Chin-Lift Maneuver
Jaw-Thrust Maneuver
Techniques of Artificial Ventilation
Methods of Artificial Ventilation

- Mouth-to-mask
- Two-person bag-valve mask
- Flow-restricted, oxygen-powered ventilation device
- One-person bag-valve mask
Pocket Masks
Adult, Child, and Infant Bag-Valve Masks
Positive Pressure Oxygen Percentage

Pocket face mask

- Without O₂ — 16%
- With O₂ — 45%–50%

Bag-valve mask (BVM)

- Without O₂ — 21%
- With O₂ and without reservoir — 45%–50%
- With O₂ and reservoir — 90%–100%

(cont.)
Positive Pressure Oxygen Percentage

- Flow-restricted oxygen-powered ventilation device (FROPVD)
  - 100%
Bag-Valve Mask Components

- Ventilation bag
- Oxygen supply inlet connection
- Air/oxygen intake valve
- Oxygen reservoir
- Nonrebreathing valve
- Exhalation port
- Face mask
- Oxygen supply tubing
Bag-Valve Mask Technique
Mouth-to-Mask Method

- Attach oxygen to mask at 15 lpm (if available).
- Follow same steps as BVM to obtain a seal with mask.
- Deliver each ventilation over 1 second (for all patients).
Mouth-to-Mask Ventilation
Bag-Valve Mask (Trauma)

* Same as for medical applications, EXCEPT:
  - Use jaw-thrust technique.
  - Do not tilt head or neck.
Using a Bag-Valve When Trauma Is Suspected
Signs of Inadequate Artificial Ventilation

- Chest does not rise and fall.
- Ventilating too slowly or too fast
- Heart rate does not return to normal.
If There Is No Chest Rise...

- Reposition head.
- Check for seal at mask and absence of air leaks.
- Check for blockages in BVM or tubing.
If There Is No Chest Rise…

- If chest still does not rise, try a pocket mask or manually triggered device.
Ventilating through a Stoma or Tracheotomy Tube
Ventilating a Stoma

- Clear any secretions in stoma (most common problem).
- Place head in a neutral position.
- Choose a pediatric-size mask.
- Ventilate at age-appropriate rate.
If Unable to Ventilate, Suction.

Aspiration of Stoma

Aspiration of Tube
(Insert 3–5 inches)
If There Is No Chest Rise…

- If air escapes from the mouth and/or nose when ventilating via stoma, consider sealing the stoma.
- Attempt artificial ventilation through the mouth and nose.
Flow-Restricted, Oxygen-Powered Ventilation Device
Flow-Restricted, Oxygen-Powered Ventilation Device

- Peak flow rate of 40 lpm
- Pressure relief valve that opens at 60 cm water (audible alarm also sounds)
- Use on adult patients only.
Open Airway and Apply Mask Just As with Bag-Valve Mask. Trigger Device until Chest Rises. Repeat Every 5 Seconds.
If There Is No Chest Rise…

✦ Reposition head.
✦ Check for seal at mask and absence of air leaks.
✦ Check for blockages.
FROPVD (Trauma)

- Same as for medical applications, EXCEPT:
  - Use jaw-thrust technique
  - Do not tilt head or neck
  - Use extreme caution to not worsen chest injuries with overinflation
Airway Adjuncts
Rules for Airway Adjuncts

- Open airway manually first.
- Ensure there is no gag reflex for oral airway, no possible skull fracture for nasal airway.
- Maintain manual airway method even with airway in place.
Rules for Airway Adjuncts

- Do not force tongue into pharynx.
- Have suction available.
- Remove adjunct if patient gags or regains consciousness.
- Maintain infection control.
Oropharyngeal Airways (OPA)
An Oral Airway Can Help Prevent the Tongue from Obstructing the Airway of an Unresponsive Patient without a Gag Reflex.
Oral Airway Technique

(cont.)
Oral Airway Technique

You can also insert an oral airway right-side-up, IF you use a tongue depressor to press the tongue down and forward.

*If adjunct seems too long or short, remove it and select a better size.*
Nasopharyngeal Airways (NPA)
Nasal Airway Technique
Techniques of Suctioning
Purpose of Suctioning

To remove blood, other liquids, and food from the airway

WHEN YOU HEAR GURGLING, SUCTION!
Types of Suction Units

- Mounted
- Battery-Powered
- Oxygen-Powered
- Manual Suction
Suction Catheters

- Hard
  - Useful for most secretions
- Soft
  - Useful for nasopharynx and when hard catheter won’t work
Rules of Suctioning

- Always use infection-control measures.
- Suction for no more than 15 seconds at a time (fewer in children and infants).
- Place tip of catheter where you want to begin suctioning, and suction on way out.
Suctioning Technique
Suctioning Longer than 15 Seconds

The second rule is to try to limit suction to no longer than 15 seconds. This is because prolonged suctioning will cause hypoxia and death. If the patient continues to vomit longer than 15 seconds, you must still continue to suction.

Ventilating foreign matter into the lungs will also cause hypoxia and death. In short, suction quickly and efficiently for as short a time as possible.
Supplemental Oxygen
Conditions Requiring Oxygen

- Respiratory/cardiac arrest
- Stroke
- Shock
- Blood loss/fractures
- Many other conditions
Portable Oxygen Cylinders
Fixed Oxygen Cylinders
Oxygen Delivery System
Oxygen Delivery System

(cont.)
Oxygen Delivery System
Safety with Oxygen

- Inspect before using.
- Use nonsparking wrenches.
- Store and maintain cylinders properly.
- Do not drop cylinders or leave standing unsecured.
- Do not smoke or use near open flame.
Administering Oxygen

- If the patient is not breathing, use artificial ventilations.

- If the patient is breathing and needs supplemental oxygen, use:
  - Nonrebreather mask, OR
  - Nasal cannula
**Nonrebreather Mask**

- Can deliver up to 90% oxygen
- Must fill bag before placing mask on patient
- Use setting of 8–15 lpm
- Adult, child, and pediatric sizes
Nonrebreather Mask
Nonrebreather Mask Technique
Nasal Cannula

* Delivers low-concentration oxygen (24–44%)
* Useful for patients who do not tolerate mask
* Use a setting of 2–6 lpm.
Nasal Cannula
Supplemental Oxygen Percentage

- **Nonrebreather mask**
  - Without reservoir $O_2$ — 45%–50%
  - With reservoir — 90–100%

- **Nasal cannula**
  - 1–lpm $O_2$ — 24%  
    2–lpm — 28%
  - 3–lpm $O_2$ — 32%  
    4–lpm — 36%
  - 5–lpm $O_2$ — 40%
Special Considerations
Facial Injuries

There are many blood vessels in the face. This can lead to two problems:

- Severe swelling from blunt injury
- Bleeding into the airway
Dentures

- Leave in place under ordinary circumstances; remove if they block airway.

- If a partial plate becomes loose, leave it in place unless it causes a problem.
Infants and Children

- Avoid excessive hyperextension when opening the airway.
- Avoid excessive pressure when ventilating.
- Gastric distention may be common.
- Use properly sized BVM, nonrebreather, and suction equipment.
Review Questions

1. Name the main structures of the airway.

2. Explain why care for the airway is the first priority of emergency care.

3. Name the signs of adequate breathing and of inadequate breathing.

(cont.)
4. Explain when the head-tilt, chin-lift maneuver should be used and when the jaw-thrust maneuver should be used to open the airway—and why.
5. Name the techniques of artificial ventilation in the recommended order of preference.

6. Explain how airway adjuncts and suctioning help in airway management and artificial ventilation.

(cont.)
7. Name patient problems that would benefit from administration of oxygen and explain how to decide whether a nonrebreather mask, or nasal cannula, or Venturi mask should be used to deliver oxygen to a patient.
Street Scenes

What is your first priority when starting to assess this patient?

What type of emergency care should you be prepared to give?
Street Scenes

What equipment should you have taken into the house to make sure you are properly prepared for this call?
Street Scenes

What is the best way to determine if the ventilations are adequate?

What additional assessment should be done on this patient?