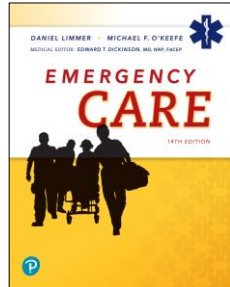


Emergency Care

Fourteenth Edition



Chapter 9

Airway Management

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Case Study

You are dispatched by state radio to a residence for a patient who "is very sick" with an unknown problem.

When you arrive you observe a male in his 40's who is lying on the floor with a makeshift tourniquet on his arm and a syringe with needle nearby.

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Case Study

The patient is pale, has cyanotic lips, and breathing that is very shallow and slow. You also observe vomit nearby on the floor.

- What life threats are evident so far?
- What immediate interventions are needed?
- What equipment will be required on scene?

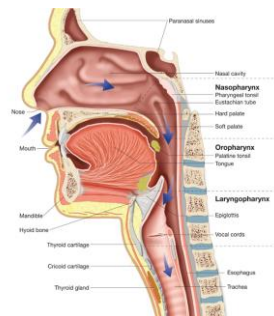
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Upper Airway



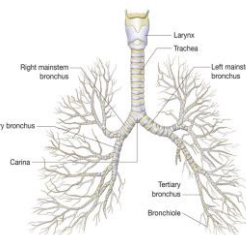
- Where
- What happens

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Airway Physiology

- Lower airway
 - The trachea lies below the larynx
 - Mainstem bronchi branch from the trachea and progressively become smaller

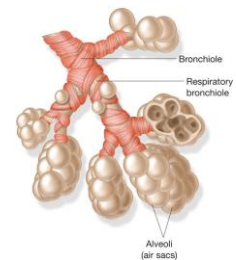


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Airway Physiology

- Alveoli lie at the end of the bronchi
 - Pulmonary capillaries surround the alveoli
 - Oxygen and carbon dioxide are exchanged at the capillaries

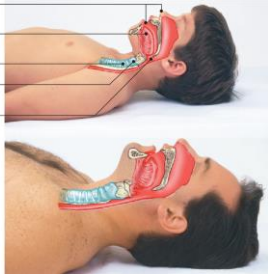


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Pediatric Anatomical Considerations

- Child has smaller nose and mouth.
- In child, more space is taken up by tongue.
- Child's trachea is narrower.
- Cricoid cartilage is less rigid and less developed.
- Airway structures are more easily obstructed.



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Four Key Components

- Pulmonary Ventilation
 - Air moving in/out of the lungs
- External Respiration
 - Gas exchange between alveoli and pulmonary capillaries
- Internal Respiration
 - Delivery of O₂ to the cells, removal of CO₂
- Cellular Respiration & Metabolism
 - Breakdown of glucose to produce ATP

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Airway Pathophysiology

- Acute obstructions
 - Foreign bodies
 - Vomit
 - Blood
- Chronic obstructions
 - Edema from burns, trauma, or infection
 - Decreasing mental status
- Providers must initially evaluate airway and monitor patency over time.



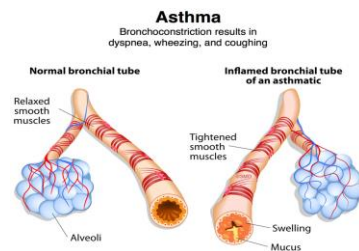
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Airway Pathophysiology



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Airway Pathophysiology—Sounds of a Partially Obstructed Airway

- Four sounds can be indicative of limited air movement
 - Stridor—High-pitched whistling sound; indicative of a severely narrowed air passage
 - Hoarseness—Raspy change in voice; indicative of swelling around the vocal cords
 - Snoring—Similar to a snore during sleep; indicative of diminished muscle tone
 - Gurgling—Bubbling sound; indicative of vomit, blood, or secretions in the airway

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Patient Assessment—Is the Airway Open? (1 of 2)

- Two questions must be answered when assessing the airway
 - Is airway open?
 - Will airway stay open?
- The ability to speak is an immediate indicator that the patient is capable of moving air
- Stridor may be present on inhalation, exhalation, or both and is an ominous sign

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Patient Assessment—Is the Airway Open? (2 of 2)

- Breathing sounds from the nose and mouth should be free of sounds associated with obstruction
 - Gurgling
 - Gasping
 - Crowing
 - Wheezing
 - Snoring
- Some patients use body position to keep the airway open
- Assess the airway in the primary assessment and stop and fix problems immediately



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Patient Assessment—Will the Airway Stay Open?

- Airway assessment is not just a moment in time, but a constant consideration
 - This is especially true in critical care patients
 - You may need to consider how to keep an airway open immediately after establishing it
- When the airway is partially obstructed, you must consider how long until it will be completely obstructed
- The ability to maintain an airway can change over time
 - Mental status affects the ability to maintain an airway
 - There is no guarantee an airway will remain open



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Patient Assessment—Signs of an Inadequate Airway (1 of 2)

- No signs of breathing or air movement
- Evidence of foreign bodies in the airway
- No air felt or heard at the nose or mouth
- Inability to speak or difficulty speaking
- Unusual hoarse or raspy quality to the voice
- Absent, minimal, or uneven chest movement



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Patient Assessment—Signs of an Inadequate Airway (2 of 2)

- Breathing movement limited to the abdomen
- Diminished or absent breath sounds
- Abnormal noises such as wheezing, crowing, stridor, snoring, gurgling, or gasping during breathing
- In children, retractions above the clavicles and between and below the ribs
- In children and infants, nasal flaring



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Opening the Airway

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Opening the Airway (1 of 2)

- Airway problems must be dealt with immediately
- Open and maintain the airway in any patient who cannot do so for himself
- In a patient with diminished mental status, airway procedures are best done with the patient supine
- If you suspect spinal trauma, protect the head and neck
 - Airway has priority over spine protection
 - Provide manual stabilization if time does not allow for spinal precautions



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Opening the Airway (2 of 2)

- In unconscious patients, watch for indications of head, neck, and spinal injury:
 - The mechanism of injury causes such injuries
 - The injury is at or above the level of the shoulders
 - Family or bystanders indicate such injuries occurred
- Some patients have open but threatened airways
 - Conscious patients should be helped into a comfortable position
 - Unconscious patients should be placed in a head-elevated, sniffing position



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Opening the Airway—Head-Elevated, Sniffing Position (1 of 2)

- The slight elevation and anterior positioning of the head aligns airway structures for improved patency
- The head is moved in an anterior fashion similar to the posture used to sniff flowers
 - In supine patients, this may be achieved with 1.5 to 2.0 inches of padding behind the head
 - Anatomy and head size can create unique positioning needs
 - In pediatric patients, padding may be needed behind the shoulders



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Opening the Airway—Head-Elevated, Sniffing Position (2 of 2)

- Optimal position is achieved when the patient's ear is at the same level as the suprasternal notch
- The position may be contraindicated when there is risk of spinal injury



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Opening the Airway—Providing an Airway: Manual Maneuvers (1 of 4)

- Patients without an intact airway require manual airway opening and ongoing interventions to support patency
- Airway problems are often caused by diminished control of muscles in the airway
- Basic procedures keep the tongue in position and prevent the epiglottis from covering the glottic opening.
- The head-tilt chin lift maneuver and the jaw-thrust maneuver are commonly used.



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Opening the Airway—Providing an Airway: Manual Maneuvers (2 of 4)

- The head-tilt, chin-lift maneuver aligns the airway structures to provide for free passage of air
 1. Place one hand on the forehead and the fingertips of other hand at the center of the lower jaw
 2. Tilt the head by applying pressure to the forehead
 3. Lift the chin and support the lower jaw
 4. Move the jaw forward
 5. Do not allow mouth to close



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Head-Tilt, Chin-Lift Maneuver



Head-tilt, chin-lift maneuver, side view. Right image shows EMT's fingertips under the bony area at the center of the patient's lower jaw.



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Opening the Airway—Providing an Airway: Manual Maneuvers (3 of 4)

- The jaw-thrust maneuver is used to open the airway of an unconscious patient with spinal injury
 1. Keep the head, neck, and spine aligned, moving patient as a unit into the supine position
 2. Kneel at the top of the head
 3. Place one hand on each side of the lower jaw, at angles of jaw below ears



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Opening the Airway—Providing an Airway: Manual Maneuvers (4 of 4)

5. Push angles of the lower jaw forward with index fingers
6. Retract the lower lip with your thumb to keep the mouth open
7. Do not tilt or the head



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Jaw-Thrust Maneuver



Jaw-thrust maneuver, side view. Inset shows EMT's finger position at angle of the jaw just below the ears.



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Obstructed Airways

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Obstructed Airways (1 of 4)

- If an opened airway remains obstructed, consider the possibility of a foreign-body obstruction
- If attempts to ventilate and reopen the airway fail, immediately begin foreign-body airway procedures
- Choking is classified as severe or nonsevere
 - In severe choking, the trachea is fully blocked and no air is moving
 - In nonsevere choking, the trachea is partially blocked and some air is exchanged



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Obstructed Airways (2 of 4)

- Conscious, severely choking adults are treated with abdominal thrusts
 - Stand or kneel behind the patient
 - Place a fist over the navel and grasp the fist with the other hand
 - Press the fist into the abdomen with a quick, forceful upward thrust
 - Repeat the thrust until the obstruction clears or the patient becomes unconscious



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Obstructed Airways (3 of 4)

- Conscious, severely choking infants are treated with back slaps and chest thrusts
 - Lay the infant along the forearm in a prone position with the head lower than the body
 - Support the head with your hand
 - Deliver five forceful back slaps with the other hand
 - Cradle the infant with the forearms and turn him over with head lower than the body
 - Deliver five rapid chest thrust at one per second
 - Alternate slaps and thrust until the obstruction clears or the patient becomes unconscious



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Obstructed Airways (4 of 4)

- If you cannot wrap both arms around the adult patient to deliver thrusts, position the hands over the sternum
- If the choking patient is unconscious or becomes unconscious during airway maneuvers, begin CPR



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Airway Adjuncts

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Airway Adjuncts

- Manual maneuvers open the airway, but an obstruction may resume when a maneuver is released
- Airway adjuncts aid in maintaining an open airway
- There are two common types of airway adjuncts
 - Oropharyngeal airway (OPA)
 - Nasopharyngeal airway (NPA)
- The main function of these devices is to keep the tongue from blocking the airway when muscle tone is diminished



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Airway Adjuncts—Rules for Using Airway Adjuncts (1 of 2)

- Use an OPA only on patients not exhibiting gag reflex
 - Gag reflex may reappear as a patient regains consciousness
 - If an OPA is not tolerated, an NPA may be
- Open patient's airway manually before using an adjunct device
- When inserting the airway, take care not to push patient's tongue into pharynx
- Have suction ready prior to inserting any airway



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Airway Adjuncts—Rules for Using Airway Adjuncts (2 of 2)

- Do not continue inserting airway if patient begins to gag
- Maintain head position after adjunct insertion and monitor the airway
- Continue to be ready to provide suction if fluid obstructs the airway
- If patient regains consciousness or develops a gag reflex, remove the airway immediately
- Use infection control practices while maintaining airway



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Airway Adjuncts—Oropharyngeal Airway (1 of 9)

- An OPA is a curved plastic device inserted in the mouth to keep the airway open
 - It has a flange that rests against the patient's lips
 - It moves the tongue forward as it curves back to the pharynx
- OPAs come in standard sizes
 - Range in size from infant to adult
 - A complete set should always be carried
 - An airway is not effective unless it is the correct size



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Airway Adjuncts—Oropharyngeal Airway (2 of 9)



Oropharyngeal airways.



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Airway Adjuncts—Oropharyngeal Airway (3 of 9)

- To determine size, measure the device from the corner of the mouth to the tip of the earlobe on the same side
- Alternatively, measure from the center of the mouth to the angle of the lower jaw bone
 - Do not use a device unless you have measured and verified size
 - If the airway used is too big, air will be directed into the stomach instead of the lungs



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Airway Adjuncts—Oropharyngeal Airway (4 of 9)



Measure from the corner of the patient's mouth to the tip of the earlobe.



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Airway Adjuncts—Oropharyngeal Airway (5 of 9)



Alternatively, measure from the center of the mouth to the angle of the lower jaw bone.



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Airway Adjuncts—Oropharyngeal Airway (6 of 9)

- Steps for inserting an OPA:
 1. Place patient on his back, and use appropriate manual method to open the airway
 2. Open the mouth with a crossed-finger technique
 3. Position the airway device with the tip pointing toward roof of mouth
 4. Insert the device along the roof of the mouth



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Airway Adjuncts—Oropharyngeal Airway (7 of 9)



Use a crossed-fingers technique to open the patient's mouth.



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Airway Adjuncts—Oropharyngeal Airway (8 of 9)



Insert the airway with the tip pointing to the roof of the patient's mouth.



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Airway Adjuncts—Oropharyngeal Airway (9 of 9)

- Steps for inserting an OPA:
 1. Gently rotate airway 180 degrees so the tip is pointing down into patient's pharynx
 2. Position the patient
 3. Check that the flange of the airway is against the patient's lips
 4. Monitor the patient closely



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Airway Adjuncts—Nasopharyngeal Airway (1 of 6)

- A NPA is used when there is an intact gag reflex, teeth are clenched, or there are oral injuries
- May be contraindicated with basilar skull fracture, epistaxis, or nasal trauma
- Soft, flexible airways should be used in the field rather than rigid, clear plastic airways



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Airway Adjuncts—Nasopharyngeal Airway (2 of 6)

- Steps for inserting a NPA:
 1. Measure for correct size from nostril to the tip of the earlobe or the angle of the jaw
 2. Lubricate the outside of the tube with water-based lubricant before insertion
 3. Push the tip of the nose upward and insert the airway
 - Keep the head in a neutral position
 - Point the bevel toward the base of the nostril or toward the septum



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Airway Adjuncts—Nasopharyngeal Airway (3 of 6)



Measure the nasopharyngeal airway from the patient's nostril to the tip of the earlobe or to the angle of the jaw.



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Airway Adjuncts—Nasopharyngeal Airway (4 of 6)

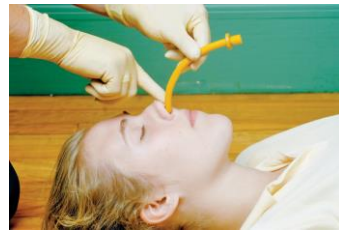


Apply a water-based lubricant before insertion.



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Airway Adjuncts—Nasopharyngeal Airway (5 of 6)



Gently push the tip of the nose upward, and insert the airway with the beveled side toward the base of the nostril or toward the septum (wall that separates the nostrils). Insert the airway, advancing it until the flange rests against the nostril.



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Airway Adjuncts—Nasopharyngeal Airway (6 of 6)

- Steps for inserting a NPA:
 4. Insert into the nostril
 - Advance along the floor of the nasopharynx
 - The flange should rest firmly against the nostril



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Airway Adjuncts—Supraglottic Airway (1 of 3)

- Supraglottic airways isolate the glottic opening by occupying space in the larynx and hypopharynx
- Airways are indicated when other, basic measures have failed
- May also be used if the airway must be maintained over a long period
- Specific insertion steps vary by airway manufacturer



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Airway Adjuncts—Supraglottic Airway (2 of 3)

- General steps for inserting a supraglottic airway:
 1. Prepare the patient
 - Attempt simple procedures first
 - If these fail, position the patient's head
 - Preoxygenate the patient
 2. Prepare the team
 - Discuss roles and responsibilities
 - Assign suction, assessment, and equipment duties



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Airway Adjuncts—Supraglottic Airway (3 of 3)

- General steps for inserting a supraglottic airway:
 3. Prepare the device
 - Size the device per manufacturer's instructions
 - Attach and check any required inflation devices
 - Prepare suction



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Suctioning

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Suctioning—Using Gravity to Clear an Airway

- Foreign materials that remain in the airway may be forced into the trachea and lungs, causing complications
- Gravity can be used to clear fluids from the mouth by turning the patient to one side and allowing fluids to drain
 - This is fast compared to technical alternatives
 - It can be done while devices are being prepared
 - It cannot be done with spinal injuries or when there is a single responder
- When using gravity, always turn the patient away from your body



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Suctioning—Suctioning Devices (1 of 7)

- Suctioning uses a vacuum device to remove foreign materials from the airway
- A patient with fluid or secretions present or a gurgling sound should be suctioned immediately
- Each suction unit includes:
 - Suction source
 - Collection container
 - Tubing
 - Suction tips or catheters



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Suctioning—Suctioning Devices (2 of 7)

- Vehicle mounted or on-board suction units:
 - Create a suctioning vacuum using the engine's manifold or an electrical power source
 - Must furnish an air intake of at least 30 liters per minute at the end of the collection tube
 - Must generate a vacuum of no less than 300 mmHg when collecting tube is clamped



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Suctioning—Suctioning Devices (3 of 7)

- Portable suction units:
 - May be oxygen or air-powered, electrically powered, or manual
 - Must provide an amount of suction identical to that of an on-board unit



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Suctioning—Suctioning Devices (4 of 7)



A mounted suction unit installed in the ambulance's patient compartment.



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Suctioning—Suctioning Devices (5 of 7)

- Operation of a suction unit requires:
 - Tubing
 - Suction tips
 - Suction catheters
 - Collection container
 - Container of clean or sterile water



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Suctioning—Suctioning Devices (6 of 7)

- The most popular suction tip is the rigid pharyngeal tip, also called a Yankauer or tonsil tip
 - It allows mouth and pharyngeal suction with excellent device control
 - It has a larger bore than more flexible catheters
 - It is most successful with unresponsive patients
- Suction catheters are flexible plastic tubes
 - Come in sizes identified by a number "French"
 - Designed for use in situations when a rigid tip cannot



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Suctioning—Suctioning Devices (7 of 7)

- The collection container should be non-breakable and easily removable
- The water container is used to clear partially blocked tubing



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Suctioning—Pediatric Suctioning

- Infants are very sensitive to vagal stimulation from catheter contact with the hypopharynx
 - They respond with a slowing of the heart rate
 - Minimize the necessary suctioning time and take care to avoid hypopharyngeal contact
 - Bulb syringe suctioning is common in infants and small children
 - It is very effective in clearing small airways
- Used in child birth and when infants experience respiratory distress



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Suctioning—Suctioning Techniques (1 of 2)

- Always use appropriate infection control practices while suctioning
- When possible, limit suctioning to no longer than 10 seconds at a time
- Place tip or catheter where you want to begin suctioning and suction on the way out
- Suction is best delivered with the patient on his side
- Suction devices may activate the gag reflex or stimulate vomiting



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Suctioning—Suctioning Techniques (2 of 2)



[For long description, see slide 88: Appendix 4](#)

Position yourself at the patient's head and turn the patient's head or entire body to the side.



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Keeping an Airway Open: Definitive Care

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Keeping an Airway Open: Definitive Care

- Keeping the airway open may exceed capabilities of a basic EMT
- Rapidly evaluate and treat airway problems
- Quickly recognize when more definitive care is needed
 - May be Advanced Life Support intercept
 - May be closest hospital



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Special Considerations

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Special Considerations (1 of 2)

- Facial injuries
 - Bleeding may require frequent suctioning
 - An airway adjunct or endotracheal tube may be needed
- Obstructions
 - Suction units are not adequate for removing solid objects
 - Use abdominal thrusts, chest thrusts, or finger sweeps



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Special Considerations (2 of 2)

- Dental appliances
 - Dentures should be left in place during airway procedures
 - Partial dentures may become dislodged during an emergency
 - Be prepared to remove a device if it endangers the airway



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Chapter Review



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Chapter Review (1 of 2)

- The airway is the passageway by which air enters the body during respiration, or breathing.
- A patient cannot survive without an open airway.
- Airway adjuncts—the oropharyngeal and nasopharyngeal airways—can help keep the airway open.



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Chapter Review (2 of 2)

- It may be necessary to suction the airway or to use manual techniques to remove fluids and solids from the airway before, during, or after artificial ventilation.



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Remember

- Always use proper personal protective equipment when managing an airway.
- Airway assessment must be an ongoing process. Airway status can change over time.
- Airway management should start simply and become more complicated only if necessary.



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Questions to Consider (1 of 2)

- Name the main structures of the airway.
- Explain why care for the airway is the first priority of emergency care.
- Describe the signs of an inadequate airway.



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Questions to Consider (2 of 2)

- 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.
- Explain how airway adjuncts and suctioning help in airway management.



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Critical Thinking (1 of 3)

- On arrival at the emergency scene, you find an adult female patient with gurgling sounds in the throat and inadequate breathing slowing to almost nothing. How do you proceed to protect the airway?



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Critical Thinking (2 of 3)

- When evaluating a small child you hear stridor. What does this sound tell you? What are your immediate concerns regarding this sound?



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Critical Thinking (3 of 3)

- When assessing an unconscious patient, you note snoring respirations. Should you be concerned with this and, if so, what steps can you take to correct this situation?



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Appendix 1

The diagram depicts a cross section of a human head and neck with labeled components of the upper airway. Paranasal sinuses are located around eye level on the left and right side of the head. The nasal cavity is in line with the nose. The nasopharynx is below the nasal cavity and includes the pharyngeal tonsil, Eustachian tube, hard palate, and soft palate. Below the nasopharynx is the oropharynx which includes the palatine tonsil and tongue. The mandible, or lower jawbone, is in line with the oropharynx on the front side of the face and the hyoid bone is in line with the base of the mandible. Below the oropharynx is the laryngopharynx which includes the epiglottis and vocal chords. On the front side of the larynx are the thyroid cartilage, cricoid cartilage, and thyroid gland. Below the larynx are the Esophagus and trachea.

[Return to presentation](#)



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Appendix 2

The lower airway begins with the larynx and the trachea in the throat. The trachea leads into the lungs and branches into the right main stem bronchus and the left main stem bronchus. The carina, which is part of the trachea, runs between the two main stem bronchi. Secondary bronchus and tertiary bronchus are attached to the main stem bronchi with bronchiole located at the outermost tip of the tertiary bronchi.

[Return to presentation](#)



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Appendix 3

The following points describe the features of a child's nose, tongue, trachea, cricoid cartilage, and airway structures.

- A child has smaller nose and mouth.
- In child, more space is taken up by tongue.
- Child's trachea is narrower.
- Cricoid cartilage is less rigid and less developed.
- Airway structures are more easily developed.

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Appendix 4

An EMT turns a patient's head to the side while holding an oxygen mask toward her face as another EMT sits behind the patient holding a catheter attached to a mounted suction unit.

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