Chapter 11, Airway Management

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1. Introduction to Airway Management

- airway management is a **crucial skill** in emergency care. [2]
- It involves recognizing and managing **adequate and inadequate breathing**. [2]
- Maintaining an open airway is a **primary component** of addressing life threats. [5]
- When breathing is disrupted, **oxygen delivery** to tissues is compromised. [6]
- Oxygen reaches body cells through **breathing and circulation**. [6]

2. Anatomy of the Respiratory System

Airway Division	Structures	Functions
Upper Airway	Nose, mouth, oral cavity, pharynx, larynx (above vocal cords)	Warm, filter, and humidify air [10]
Lower Airway	Trachea, bronchi, bronchioles, alveoli (below vocal cords)	Deliver oxygen to alveoli [32]

- The **pharynx** is a muscular tube extending from the nose and mouth. [11]
  - It includes the **nasopharynx**, **oral pharynx**, and **laryngopharynx**. [12]
  - The **nasopharynx** filters, warms, and humidifies air. [14]
  - The **oropharynx** is the posterior part of the oral cavity. [16]
  - The **epiglottis** helps prevent food and liquid from entering the larynx. [16]
- The **larynx** is a complex structure of cartilage. [18]
  - It marks the division between the upper and lower airways. [19]
  - Key structures include the **thyroid cartilage** (Adam's apple), **cricoid cartilage**, and **cricothyroid membrane**. [20]
  - The **glottic opening** is the narrowest part of the adult airway. [27]
  - **vocal cords** produce speech and protect the trachea. [29]
- The **trachea** is the air entry to the lungs. [32]
  - It begins below the cricoid cartilage. [33]
  - It divides at the **carina** into the main stem bronchi. [35]
- **Bronchi** distribute oxygen to the lungs and divide into smaller bronchioles. [36]
  - **Bronchioles** are smooth muscle and dilate or constrict. [41]
- **alveoli** are the site of oxygen and carbon dioxide exchange. [42]
  - They are thin-walled sacs surrounded by **pulmonary capillaries**. [43]
  - Oxygen diffuses into capillaries, and carbon dioxide diffuses out. [44]
- The **mediastinum** is the area between the lungs. [48]
  - It contains the heart, great vessels, esophagus, trachea, bronchi, and nerves. [48]
- The **phrenic nerve** is necessary for the diaphragm to contract for breathing. [50]

3. Physiology of Breathing

- The respiratory and cardiovascular systems work together. [52]
  - They ensure a constant supply of oxygen and nutrients. [52]
  - They remove carbon dioxide and waste products. [53]
- **ventilation** is the physical act of moving air. [55]
  - It is necessary for oxygenation and respiration. [55]
- **Inhalation** is the active part of breathing. [57]
  - The diaphragm and intercostal muscles contract. [58]
  - This creates negative pressure in the thorax. [59]
  - Air enters the body and travels to the lungs. [59]
- **Partial pressure** is the amount of gas in air or dissolved in fluid. [62]
  - Oxygen and carbon dioxide diffuse until partial pressures are equal. [66]
- **tidal volume** measures the depth of breathing. [69]
  - The average adult tidal volume is about 500 milliliters. [70]
- **Dead space** is inspired air that does not reach the alveoli. [71]
- **Exhalation** is a passive process. [73]
  - Muscular effort is not required. [73]
  - Diaphragm and intercostal muscles relax, decreasing thorax size. [74]
  - Air pressure increases, pushing air out. [74]
- **Regulation of ventilation** involves receptors and feedback loops. [75]
  - These sense gas concentrations and adjust breathing rate and depth. [76]
- **hypoxia** is a condition where tissues cannot get enough oxygen. [77]
- The **hypoxic drive** uses oxygen to control breathing. [80]
  - It is typically seen in patients with end-stage COPD. [81]
- **oxygenation** is loading oxygen molecules onto hemoglobin. [82]
  - It is required for internal respiration. [83]
  - ventilation without oxygenation can occur in low-oxygen environments. [84]
- **respiration** is the exchange of oxygen and carbon dioxide. [85]
  - This occurs in the alveoli and body tissues. [85]
  - Metabolism is cellular respiration, producing energy and waste. [86]
- **External respiration** is the exchange in the alveoli and pulmonary capillaries. [88]
  - **Surfactant** reduces surface tension in alveoli, aiding gas exchange. [89]
- **Internal respiration** is the exchange between the systemic circulatory system and cells. [91]

    - Oxygen moves from blood to tissues, and carbon dioxide moves from cells to blood. [92]
- Cells need a constant supply of oxygen for **aerobic metabolism**. [93]
    - Without adequate oxygen, **anaerobic metabolism** occurs, which is insufficient. [94]

4. Pathophysiology of the Respiratory System

Factor	Description	Examples
Nervous System Input	Chemoreceptors monitor gas and ion levels, stimulating respiratory centers.	Increased carbon dioxide or hydrogen ions lead to increased respiratory rate. [97]
Ventilation/Perfusion Mismatch	Failure to match ventilation and perfusion leads to abnormal gas exchange.	Blood passes over alveoli without gas exchange. [101]
Intrinsic Factors	Conditions within the body affecting ventilation.	Airway obstruction, infections, allergic reactions, unresponsiveness (tongue). [105]
Extrinsic Factors	External factors affecting ventilation.	Trauma causing airway obstruction. [106]
Factors Affecting Respiration	Conditions affecting gas exchange at the alveolar or tissue level.	External: Low atmospheric or partial pressure of oxygen. [109]
Internal Factors	Conditions reducing surface area for gas exchange or decreasing oxygen supply.	Pneumonia, pulmonary edema, COPD. [110]

Circulatory Compromise	Obstruction of blood flow to cells and tissues.	Trauma (pneumothorax, hemothorax), blood loss, anemia, shock. [111]

- **chemoreceptors** provide feedback to the respiratory centers in the brain. [96]
- Stimulation from the **pons** affects the rate and depth of respirations. [98]
- A **ventilation and perfusion mismatch** is a common cause of abnormal gas exchange. [100]
  - This occurs when ventilation is compromised but perfusion continues. [101]
  - It can also occur when perfusion across the alveolar membrane is disrupted. [104]
- **Intrinsic factors** are inside the body. [105]
  - Unresponsiveness can cause the tongue to block the airway. [105]
- **Extrinsic factors** are outside the body. [106]
  - Trauma is an example. [107]
- Factors affecting respiration can be **external** (environmental) or **internal** (conditions). [109]
- **Circulatory compromise** can be caused by trauma or other conditions. [111]

5. Patient Assessment of the Respiratory System

- Wear a mask and protective eyewear during **aerosol generating procedures (AGP)**. [113]
  - AGPs include CPR, nebulizer treatments, and CPAP. [114]
- Recognizing **adequate breathing** is important. [115]
  - Normal breathing in adults is 12 to 20 breaths per minute. [115]
  - Signs include a regular pattern, clear and equal lung sounds, and regular chest rise and fall at an adequate depth. [116]
- Signs of **abnormal breathing** include: [117]
  - Fewer than 12 or more than 20 breaths per minute with shortness of breath. [117]
  - Irregular rhythm or diminished breath sounds. [119]
  - Reduced flow of expired air at the nose or mouth. [120]
  - Unequal or inadequate chest expansion. [121]
  - Increased effort using accessory muscles. [122]

    - Shallow depth, reducing tidal volume. [123]
    - Pale, cyanotic, cool, or moist skin. [124]
    - Skin pulling in around the ribs or above the clavicles (**retractions**). [124]
- **agonal gasps** are occasional gasping breaths after the heart has stopped. [125]
- Abnormal respiratory patterns include: [126]
    - **Cheyne-Stokes respirations**: increasing rate and depth followed by apnea, often seen in stroke or head injury. [126]
    - **Ataxic respirations**: irregular or unidentifiable pattern, may follow serious head injuries. [127]
    - **Kussmaul respirations**: deep, rapid respirations, commonly seen in metabolic acidosis. [129]
- Patients with inadequate breathing need **immediate treatment**. [130]
    - This includes airway management, supplemental oxygen, and ventilatory support. [130]
- Assessment of respiration considers factors like high altitudes or poisonous gases. [132]
- **Level of consciousness** and **skin color** are indicators of respirations. [133]
- **pulse oximetry** (SpO2) measures the percentage of hemoglobin bound to oxygen. [134]
    - SpO2 should be greater than 94% when breathing room air. [134]
    - Oxygen is applied when SpO2 is less than 94% in conditions like stroke or heart attack. [135]
    - Pulse ox values may take time to reflect changes. [136]
    - It is a routine vital sign. [137]
- **end tidal co2** measures the maximal CO2 concentration at the end of exhalation. [138]
    - Low CO2 may indicate hyperventilation or decreased CO2 return. [138]
    - High CO2 may indicate CO2 retention or apnea. [139]
    - It is measured using **capnometry** (numeric reading) and **capnography** (numeric reading and graph). [140]
    - Normal range is 35 to 45 millimeters mercury. [142]

6. Opening the Airway

Maneuver	Indication	Technique
Head-Tilt Chin-Lift	No spinal cervical spine injury suspected. [148]	Place heel of hand on forehead, apply backward pressure, place fingertips under jaw and lift upward. [149]
Jaw-Thrust	Cervical spine injury suspected. [150]	Kneel above head, place fingers behind jaw angles, move jaw upward using thumbs. [150]

- Emergency care starts with ensuring an **open airway**. [143]
- The patient should be in the **supine position**. [144]
  - Unconscious patients should be moved as a unit due to potential spinal injury. [145]
- The most common airway obstruction in an unconscious patient is the **tongue**. [146]
  - It falls back into the throat when muscles relax. [146]
- The **head tilt chin lift maneuver** opens the airway in most patients. [147]
  - It is used when spinal cord trauma is not suspected. [148]
- The **jaw thrust maneuver** is used when spinal cord injury is suspected. [150]
- To open the mouth, use the **cross finger technique**. [151]
  - Place index finger and thumb tips on teeth, push thumb on lower teeth and index finger on upper teeth. [151]

7. Suctioning

- You **must keep the airway clear** to ventilate properly. [154]
  - If the airway is not clear, fluids can be forced into the lungs, causing **aspiration**. [155]
- If you hear **gurgling**, the patient needs suctioning. [156]
- Suction equipment can be **portable** (hand-operated) or **fixed** (mounted). [158]
  - Portable units must provide enough vacuum pressure and flow. [159]
  - Fixed units should generate airflow over 40 liters per minute and vacuum over 300 mmHg. [161]
- Equipment should include **wide bore, non-kinking tubing**. [161]

    - **Plastic or rigid pharyngeal suction tips** (tonsil tips, yankauer tips) are used. [162]
    - **Non-rigid plastic catheters** (French or whistle tip) are used for the nose or liquid secretions. [164]
- Suction units should have a **disposable collection bottle**. [166]
- A **water supply** is needed for rinsing tips. [166]
- Measure the proper size using the technique for an oropharyngeal airway. [167]
- Inspect suction equipment regularly. [168]
- **Operating the suction unit** involves checking assembly, testing vacuum pressure, and selecting the attachment. [169]
- Never suction the mouth or nose for more than **15 seconds for an adult**, **10 seconds for a child**, or **5 seconds for an infant**. [171]
    - Suctioning can result in **hypoxia**. [172]
- Rinse the catheter and tubing with water to prevent clogging. [172]
- Repeat suctioning only after the patient has been **adequately ventilated or re-oxygenated**. [173]
- Avoid touching the back of the airway with the catheter to prevent activating the **gag reflex**. [173]
- If secretions or vomit cannot be suctioned easily, remove the catheter, **log roll the patient onto their side**, and clear the mouth with a gloved finger. [174]
- For frothy secretions with assisted ventilation, alternate suctioning for 15 seconds (less for infants/children) and ventilating for two minutes. [176]

8. Airway Adjuncts

Adjunct	Purpose	Indications	Contraindications
Oropharyngeal Airway (OPA)	Keeps the tongue from blocking the upper airway, facilitates suctioning. [180]	Unresponsive patient without a gag reflex, apneic patient being ventilated with BVM. [181]	Conscious patients or any patient with a gag reflex. [181]
Nasopharyngeal Airway (NPA)	Used with patients who	Semi-conscious or unconscious	Severe head injury with blood from nose,

	have an intact gag reflex but cannot maintain airway. [184]	patient with an intact gag reflex, patients not tolerating OPA. [184]	fractured nasal bone history. [185]

- Basic airway adjuncts prevent upper airway obstruction by the **tongue**. [179]
- An **OPA** that is too large can push the tongue back, blocking the airway. [182]
- An **OPA** that is too small could also block the airway like a foreign body. [182]
- Insertion techniques for OPAs can involve a **90-degree rotation** if needed. [183]
- The **NPA** is used for patients who have a gag reflex. [184]

9. Recovery Position and Supplemental Oxygen

- The **recovery position** helps maintain an airway in an unconscious patient. [189]
  - This is for patients who are **not injured** and are breathing on their own with a normal rate and adequate tidal volume. [190]
  - The patient is rolled onto their **left or right side**. [191]
- Always give **supplemental oxygen** to hypoxic patients. [192]
  - Do not withhold oxygen from any patient who might benefit. [193]
- Supplemental oxygen equipment includes **oxygen cylinders**. [194]
  - Medical oxygen is usually supplied in compressed green cylinders. [195]
  - Check the cylinder label and the stamped test date. [196]
  - Aluminum cylinders are tested every five years, composite every three. [199]
  - D or jumbo D cylinder sizes are commonly used. [200]
- **Safety considerations** for oxygen cylinders are crucial. [203]
  - Handle cylinders carefully as they are under pressure. [203]
  - Ensure the correct pressure regulator is attached before transport. [203]
  - A puncture can turn a tank into a deadly missile. [204]
  - Secure cylinders with mounting brackets. [204]
- The **pin indexing system** prevents connecting a regulator to the wrong gas cylinder. [206]
  - Pin holes on the cylinder must match the pins on the regulator. [207]
- **Pressure regulators** reduce cylinder pressure to a usable range (40-70 PSI). [209]
  - Attachments can be a quick connect female fitting or a flow meter. [210]

- **Flow meters** measure gas release in liters per minute. [213]
  - **Pressure compensated flow meters** have a float ball and must be upright. [214]
  - **Bourdon gauge flow meters** can be used in any position. [215]
- There are **hazards of supplemental oxygen**. [217]
  - **Combustion**: Oxygen speeds up burning, keep fire sources away. [217]
  - Ensure adequate ventilation. [217]
- **Oxygen toxicity** refers to cellular tissue damage from excessive oxygen levels. [219]
  - Excessive oxygen can have detrimental effects on patients with certain diseases. [219]
  - Increased cellular oxygen contributes to **oxygen-free radicals**. [220]
- Current guidelines recommend tailoring oxygen therapy based on patient needs. [223]
  - Administer oxygen to maintain oxygen saturation at or above 94 percent when possible. [224]
  - Administer oxygen for patients with signs of MI, heart failure, shortness of breath, or room air saturation less than 94%. [221]
  - hypoxia is considered much worse than oxygen toxicity. [222]

10. Oxygen Delivery Equipment

Equipment Type	Description	Flow Rate & Delivered Oxygen Concentration	Notes
Non-rebreathing Mask	Mask with reservoir bag and one-way valve. [227]	10 to 15 liters per minute. [230]	Reservoir bag must be full before use, adjust flow to prevent collapse. [230]
Nasal Cannula	Small tube prongs that fit into nostrils. [233]	1 to 6 liters per minute (24-44% O2). [234]	Flow rates above 6 L/min not recommended for comfort. [235]

Partial Re-breathing Mask	Similar to non-rebreather, but patient re-breathes a small amount of air. [238]		One-way valve between mask and reservoir is absent. [238]
Venturi Mask	Has attachments to vary oxygen percentage with constant flow. [240]	Medium flow delivers 24-40% O2. [240]	Percentage varies by manufacturer. [240]
Trach Mask	Covers the tracheostomy hole. [242]		Used for patients with tracheostomies. [241]

- Common oxygen delivery equipment in the field includes non-rebreathing masks, bag valve devices, and nasal cannulas. [225]
- The one-way valve on a non-rebreathing mask prevents rebreathing exhaled gases. [229]
- A nasal cannula is used for patients with **mild hypoxia**. [235]
  - It is less effective if the patient breathes through their mouth or has a nasal obstruction. [236]
- **Humidified oxygen** may be associated with increased generation of air sliced droplets. [237]
- For patients with tracheostomies, a **trach mask** covers the opening. [241]
  - If a trach mask is unavailable, improvise by placing a **face mask over the stoma**. [243]

11. Assisted or Artificial Ventilation

- Basic airway and ventilation techniques are effective with appropriate oxygen. [246]
- Signs and symptoms of **inadequate ventilation** include altered mental status, inadequate minute volume, and excessive accessory muscle use. [247]
- When ventilation is inadequate, you need to **assist ventilations**. [248]
  - This is done with a **bag valve mask (BVM)**. [248]
- If the patient is conscious, explain the procedure. [249]
  - Place the mask over the mouth and nose and squeeze the bag with each

breath, maintaining the same rate. [250]
    - Adjust the rate and tidal volume after initial breaths to maintain adequate minute volume. [252]
- If the patient is not breathing, begin **artificial ventilation immediately**. [254]
    - Methods include **mouth-to-mask** or **one- or two-person BVM**. [255]
- **Artificial ventilations** are not the same as normal breathing. [256]
    - Normal breathing creates **negative pressure**, sucking air in. [257]
    - **Positive pressure ventilation** forces air into the chest cavity. [257]
    - Positive pressure increases intrathoracic pressure, potentially reducing blood return to the heart. [258]
    - It can force air into the stomach, causing **gastric distension**. [261]
- The EMT must regulate the rate and volume to prevent a drop in cardiac output. [263]
- **ventilation rates** for a patient not breathing but with a pulse: [264]
    - Adult: one breath every six seconds. [264]
    - Child: one breath every two to three seconds. [264]
    - Infant: one breath every two to three seconds. [264]

12. Bag-Valve Mask (BVM) and Gastric Distension

- The **mouth-to-mask technique** uses a barrier device. [268]
    - A mask with an oxygen inlet provides oxygen during this. [269]
- A **bag valve mask (BVM)** is a common device used. [269]
    - It provides less tidal volume than mouth-to-mask but delivers a high concentration of oxygen. [269]
- Components of BVM devices include: [270]
    - Disposable self-inflating mask (with a disablable pop-off valve if present). [270]
    - Inline viral filter. [271]
    - Outlet valve that is a true valve for re-breathing. [271]
    - Oxygen reservoir for high oxygen concentration. [271]
    - One-way or no-jam inlet valve system. [272]
    - Transparent face mask. [273]
    - Ability to perform under extreme conditions. [273]
- The volume of air delivered is based on observing **chest rise and fall**. [274]

- **Gastric distension** occurs when artificial ventilation fills the stomach with air. [276]
  - It is likely from ventilating too forcefully or rapidly. [277]
  - Air obstruction from a foreign body or improper head position also contributes. [277]
- Give **slow, gentle breaths** over one second to prevent distension. [278]
- Ensure the patient's airway is **properly positioned**. [279]
- Ventilate at the **appropriate rate and volume**. [279]
- If gastric distension prevents ventilation and ALS is unavailable, consider pressure over the upper abdomen as a last resort. [280]
- If vomiting occurs, **turn the patient's entire body to the side**. [281]
  - Suction or wipe out the mouth, then return to supine and continue ventilation. [282]

13. Passive Ventilation and Advanced Ventilation Devices

- **Passive ventilation** (passive oxygenation or apneic oxygenation) occurs with chest compressions. [283]
  - Compressing the chest forces air out, and recoil creates negative pressure, drawing air in. [283]
  - It can be enhanced by inserting an OPA and providing supplemental oxygen. [284]
- An **automatic transport ventilator (ATV)** or resuscitator is an advanced ventilation device. [285]
  - It allows setting ventilation variables. [286]
  - It frees the EMT to perform other tasks. [286]
  - Constant reassessment is necessary. [286]
- **Continuous positive airway pressure (CPAP)** is a non-invasive ventilation support. [287]
  - Many sleep apnea patients use it at night. [289]
  - In the pre-hospital setting, it is useful for respiratory distress from COPD, pulmonary edema, and bronchospasm. [290]
  - It is becoming a widely used EMT tool. [291]
- CPAP **increases pressure in the lungs**. [292]
  - It opens collapsed alveoli and pushes oxygen across the membrane. [292]
  - It forces interstitial fluid back into pulmonary circulation. [292]

- Therapy is typically delivered through a **face mask with a strapping system**. [293]
  - A good seal with minimal leakage is essential. [294]
- Many CPAP systems use **oxygen as the driving force**. [295]
  - Patients benefit most during exhalation. [296]
- Use caution with patients with **potentially low blood pressure**. [296]
  - CPAP causes a drop in cardiac output. [296]

14. CPAP: Indications, Contraindications, and Complications

Category	Descriptions	Examples
Indications	Patient must be alert and able to follow commands. [298]	Moderate to severe respiratory distress (pulmonary edema, COPD), respiratory distress after submersion, rapid breathing affecting minute volume, pulse ox less than 90%. [299]
Contraindications	Conditions or states where CPAP should not be used. [301]	Respiratory arrest, agonal respirations, hypoventilating, cannot speak or follow commands, cannot protect airway, hypotensive, pneumothorax, chest trauma, tracheostomy, active GI bleeding, vomiting, facial trauma, cardiogenic shock, cannot sit upright, CPAP system cannot fit, patient cannot tolerate mask. [302]
Components	Parts of a CPAP unit. [309]	Generator, mask, tubing, bacterial filter, one-way valve. [309]
Complications	Potential negative outcomes from CPAP use. [314]	Claustrophobia and resistance to mask, risk of pneumothorax (hole in the lung), lower blood pressure. [314]

- The **CPAP generator** creates resistance, creating back pressure in the airways. [310]
  - This pushes open smaller airway structures. [310]

    - Pressure can be adjusted, typically 7 to 10 is acceptable. [311]
- Most CPAP units are powered by **oxygen**. [313]
    - A full cylinder is important when using CPAP. [313]
- If a patient resists CPAP due to claustrophobia, **coach them** through the process. [314]
- If the patient shows signs of deterioration, **remove CPAP** and begin positive pressure ventilation with a BVM and high flow oxygen. [315]

15. Special Airway Considerations

- **Stomas and tracheostomy tubes** are special considerations. [316]
    - Patients with a **laryngectomy** have a permanent tracheal stoma. [317]
    - If a patient has a tracheostomy tube, ventilate through the tube with a BVM. [318]
    - Use the standard 15 to 22 mm adapter on the BVM. [319]
    - Use 100% oxygen attached to the BVM. [320]
    - If a patient has a stoma but no tube, use an infant or child mask to seal over the stoma. [321]
    - Seal the patient's mouth and nose to prevent air leaks during ventilation. [321]
    - Release the seal for exhalation. [321]
    - If you cannot ventilate a stoma patient, try suctioning with a French or soft-tipped catheter. [322]
    - Seal the stoma while giving mouth-to-mouth ventilation. [322]
- **Foreign body airway obstruction** is a true emergency if it completely blocks the airway. [323]
    - This can result in death if not treated immediately. [325]
    - In adults, it often occurs during a meal. [326]
    - In children, it can occur while eating or playing. [327]
- The most common airway obstruction in an unconscious patient is the **tongue**. [330]
- Other causes of obstruction not involving foreign bodies include **swelling from infection or allergic reactions**. [331]
    - Anaphylaxis is an example. [332]
- **Trauma** can also cause obstruction due to tissue damage. [333]
- Recognizing airway obstruction includes different levels: [334]

    - **Mild airway obstruction**: Patient can still exchange air but has respiratory distress. [334]
        - May have noisy breathing or cough forcefully. [335]
        - May hear **wheezing** between coughs. [336]
        - Do not interfere if the patient can breathe, cough forcefully, or talk. [337]
        - Encourage and continually reassess. [338]
    - **Severe airway obstruction**: Patient cannot breathe or talk. [340]
        - May be clutching their throat (universal distress sign). [341]
        - May be turning cyanotic. [341]
        - Little or no airway movement. [342]
- Emergency care for foreign body obstruction: [345]
    - Perform the **head tilt chin lift** or **jaw thrust** maneuver. [346]
    - Sweep the mouth with a gloved finger if large pieces of material are present. [348]
    - Use suction if available. [349]
- **Abdominal thrusts** are effective for conscious patients. [350]
    - They use residual air in the lungs to expel the object. [351]
    - Continue thrusts until the object dislodges or the patient becomes unconscious. [351]
- For an **unconscious patient** with foreign body obstruction: [353]
    - Reassess for apnea and inability to ventilate. [353]
    - Begin **chest compressions** as in CPR (30 compressions). [354]
    - After compressions, open the jaw and look for foreign objects. [355]
    - Remove visible objects with a gloved finger or suction. [356]
    - **Never perform a blind sweep**. [357]
    - Attempt ventilation after removing the object. [358]
    - Repeat compressions and ventilations if unable to ventilate. [359]
- **Dental appliances** can cause obstruction. [359]
    - Manually remove appliances before ventilations. [360]
    - Leave well-fitting dentures in place as they aid BVM seal. [361]
    - Remove loose dentures if they interfere. [362]
- **Facial bleeding** can cause airway problems. [363]
    - Severe bleeding and swelling can enter the airway. [364]

- Control bleeding with direct pressure and suction. [364]

16. Assisting with Advanced Life Support Procedures

- The EMT plays an essential role in assisting with **advanced airway interventions**. [366]
  - This includes assisting with **endotracheal intubation**. [367]
- The first step is **pre-oxygenation**, often with BVM ventilation. [367]
  - Use an OPA or NPA, ensure a proper seal, and use proper rate and volume. [368]
  - Maintain a high flow nasal cannula during pre-oxygenation and the intubation attempt. [370]
- **Equipment setup** for endotracheal intubation includes: [371]
  - Personal protective equipment (face mask, eye shield). [371]
  - Suction unit with rigid or non-rigid catheters. [372]
  - Laryngoscope handle and blade. [373]
  - Magill forceps. [373]
  - ET tube with stylet or introducer (gum elastic bougie). [374]
  - Water-soluble lubricant. [376]
  - 10 ml syringe. [376]
  - Confirmation device. [376]
  - Commercial ET tube securing device. [376]
  - Alternate airway management devices (supraglottic, cricothyrotomy kit). [377]
- The **B-MAGIC mnemonic** helps remember the typical steps: [378]
  - **B**: Bag valve mask preoxygenation. [379]
  - **E**: Evaluate airway difficulties. [380]
  - **M**: Manipulate the patient. [381]
  - **A**: Attempt the first pass intubation. [382]
  - **G**: Use a supraglottic airway if unable to intubate. [383]
  - **C**: Confirm success and correct any issues. [383]
- **Monitor for potential complications** after intubation. [384]
  - Signs include absence or decrease of end tidal co2 or SpO2. [384]
  - Increasing resistance when ventilating. [384]
  - Improper positioning or dislodgement of the ET tube. [385]

17. Review Questions and Answers

- Breathing is controlled by the **pons and medulla**. [387]
  - These are the respiratory centers in the brain stem. [387]
- The EMT should assess the patient's tidal volume by looking for **chest rise and fall**. [388]
  - tidal volume is the air volume moved in and out in a single breath. [388]
- In a healthy individual, breathing is stimulated by **increased levels of carbon dioxide** in the blood. [389]
  - Rising carbon dioxide levels stimulate the brain stem. [389]
- Signs of adequate breathing in an adult include normal rate, regular pattern, and clear lung sounds. Shallow chest rise is **not** a sign of adequate breathing. [390]
- If a patient vomits during OPA insertion, immediately **turn the patient onto their side**. [392]
- An NPA airway is **contraindicated** in a patient with severe head injuries or facial injuries, such as a patient who fell and landed on their head. [393]
- If a patient receiving oxygen via nasal cannula complains of burning in the nose, hook it up to **humidified oxygen**. [394]
- If an unconscious patient has slow and irregular respirations after a fall, **assist bagging this patient**. [395]
- When ventilating an apneic adult with a BVM, squeeze the bag until **visible chest rise** is noted. [398]
- If an apneic patient's stomach becomes distended during BVM ventilation, **reposition the head**. [400]
  - This could be because air is entering the esophagus. [401]