Respiratory – Aspiration Precautions

Strength of Evidence Level: 3

PURPOSE:
Implement and educate patient/caregiver on precautions that prevent aspiration.

CONSIDERATIONS:
1. Precautions should be taken with all patients who are unable to protect their airway to prevent the involuntary inhalation of foreign substances, such as gastric contents, oropharyngeal secretions, food or fluids, into the tracheobronchial passages.
2. Patients at particular risk for aspiration include those whose normal protective mechanisms are impaired.
3. Major risk factors include:
   a. Decreased level of consciousness (confusion, coma, sedation).
   b. Documented previous episode of aspiration.
   c. Neuromuscular disease and structural abnormalities of the aerodigestive tract.
   d. Depressed protective reflexes (cough or gag).
   e. Presence of an endotracheal tube.
   f. Persistently high gastric residual volumes.
   g. Vomiting.
   h. Need for prolonged supine position.
   i. Diagnosis of dysphagia.
4. Additional risk factors:
   a. Poor oral care.
   b. Malpositioned feeding tube.
   c. Presence of a large-bore naso-enteric tube.
   d. Non-continuous or intermittent tube feeding.
   e. Delayed gastric emptying.
   f. Oral surgery or trauma.
   g. Abdominal/thoracic surgery or trauma.
   h. Transport.
5. Potential outcomes from aspiration include: airway obstruction and asphyxiation, chemical pneumonia, bacterial pneumonia and/or death.

EQUIPMENT:
None

PROCEDURE:
1. Keep head of bed (HOB) elevated 30-45 degrees at all times unless medically contraindicated. If HOB cannot be raised, position patient in reverse Trendelenberg at 30-45 degrees unless medically contraindicated.
2. Perform mouth care every 4 hours and as needed. Avoid triggering the gag reflex when performing care activities, especially mouth care.
3. Monitor respiratory status and level of consciousness as follows when taking vital signs:
   a. Auscultate breath sounds. Vesicular (normal) breath sounds should be heard over the distal lung field.
   b. Observe respiratory efforts.
   c. Determine ability to effectively manage secretions.
4. Consult speech therapist for patients with dysphagia, as needed, and as ordered by healthcare provider.
5. Consult dietitian for diet evaluation, as needed (requires physician’s order).
6. If patient receiving enteral feedings, See Digestive - Gastrostomy or Jejunostomy Tube Feeding.
7. Monitor patient when eating/drinking:
   a. Instruct family or caregiver to do the same.
   b. Observe adequacy of swallowing.
   c. SN: order ST eval for tube fed patients for swallow eval as appropriate.
8. Maintain calm environment when the patient is eating or drinking.
9. If patient is unable to manage own oral secretions, nasopharyngeal suctioning may be indicated, consult with healthcare provider and refer to nasopharyngeal suctioning policy as needed.
10. Keep wire cutters at HOB of patient with wired jaws and instruct patient and caregiver in use.
11. Notify healthcare provider immediately for any signs or symptoms of aspiration such as tachypnea, cough, crackles, cyanosis, wheezing, fever or apnea as these will usually develop within two hours of the aspiration.

AFTER CARE:
1. Document in patient’s record:
   a. Maintenance of aspiration precautions.
   b. Respiratory rate, effort and quality.
   c. Patient’s response to eating/drinking and adequacy of swallowing.
   d. Instructions to patient/caregivers or family.

REFERENCES
Tracheostomy Care

Strength of Evidence Level: Blank

PURPOSE:
To ensure the proper and safe procedure when performing tracheostomy care by keeping the airway open, prevention of aspiration, atelectasis and infection control.

POLICY:
Tracheostomy care procedures for a patient with a trach with or without an inner cannula, suctioning, and tracheostomy maintenance.

Suctioning is the mechanical removal of secretions from airway to maintain an obstructed airway, allow for adequate air exchange, and prevent airway infection.

SCOPE OF RESPONSIBILITY:
Can be performed by an RN, LPN/LPN/Licensed Respiratory Care Practitioner.

PRINCIPLE:
Tracheostomy care is a series of standardized procedures used for the care and suctioning with a patient and performing dressing changes that will prevent irritation, infection around the stoma site and prevent aspiration of secretions into the lung.

PROCEDURE:

3.0 PROCEDURE

3.1 Wash your hands.
3.2 Explain the procedure in a way appropriate for a child’s age or an adult to understand.
3.3 Assemble equipment at the bedside. Place a drape absorption pad on the table.
3.4 Assure the suction apparatus is working at proper settings.
3.5 Lay the adult or child in a comfortable position on his/her back with a small blanket or towel roll under his/her shoulders to extend the neck and allow easier visualization and trach care.
3.6 Don clean gloves.
3.7 Open suction kit.
3.8 Open Q-tips, trach gauze and regular gauze.
3.9 Cut the trach ties to appropriate length (if trach ties are to be changed).
3.10 Pour ½ strength hydrogen peroxide into one cup and sterile water into the other.

3.10.1 Clean the skin around the trach tube with Q-tips soaked in ½ strength hydrogen peroxide. Using a rolling motion, work from the center outward, using 4 swabs, one for each quarter around the stoma and under the flange of the tube. Do not allow any liquid to get into the trach tube or stoma area under the tube.
3.11 Note: Check with patient’s MD to determine what solution they would recommend for use around the site. Some doctors recommend cleaning with just soap and water in home care, using hydrogen peroxide only to remove encrusted secretions, because daily use of hydrogen peroxide might irritate the skin of some children and adults.
3.12 Rinse the area with Q-tip soaked in sterile water.
3.13 Pat dry with gauze pad or dry Q-tips.
3.14 Change the trach ties if needed.
3.15 Check the skin under the trach ties.
3.16 Tuck pre-cut trach gauze around and under the trach tube flush to skin. Do not cut the gauze or use gauze containing cotton because the patient may inhale small particles.

3.16.1 Use pre-cut tracheostomy gauze or unfilled gauze opened full length and folded into a U shape or use two gauze pads, one placed under each wing of the tube.
3.16.2 Be sure the trach dressing does not fold over and cover the trach tube opening.
3.16.3 Change the dressing when moist, to prevent skin irritation. Tracheostomy dressings may not be needed for older tracheostomies when the skin is in good condition and the stoma is completely healed and free from rash or redness.
3.16.4 For tracheostomy tubes with cuffs, check with your doctor for specific cuff orders.
3.16.5 Check cuff pressures every 4 hours (usual pressure 15 – 20 mm Hg). In general, the cuff pressure should be as low as possible while still maintaining an adequate seal for ventilation.
3.16.6 Monitor skin for signs of infection. IF the stoma becomes red, swollen, inflamed, warm to touch or has a foul odor, call your doctor.
3.16.7 Check with the doctor before applying any salves or ointments near the trach.
3.16.8 If an antibiotic or antifungal ointment is ordered by the doctor, apply the ointment lightly with a cotton swab Q-tip in the direction away from the trach stoma.
3.17 Wash your hands after trach care.

2.0 Equipment

- The following are the items needed prior to performing the procedure:
- Sterile cotton tipped applicators (Q-tips)• Trach gauze and “unfilled” gauze
- Sterile water
- Hydrogen peroxide (1/2 strength with sterile water)
- Trach ties and scissors (if ties are to be changed)
- Two sterile cups or clean disposable paper cups
- Small blanket or towel roll
- Suction catheter kit or in-line dose suction kit
- Suction unit
- Connecting tubing
- Suction liner
- Oxygen source
- 5cc sterile saline for irrigational/lavage
- Sterile lubricating gel (for NT suction)
- PPE (if indicated)
- Ambu bag (if indicated)
- Yankauer (if needed)
- Nasal trumpet (if indicated)
- Trach kit
4.0 CARE OF THE INNER CANNULA

4.0.1 Some older children and teens have trachs with an inner cannula. Some inner cannulas are disposable (DIC: Disposable Inner Cannula). These should be changed daily, discarding the old cannula.

4.0.2 Check with Haven DME department regarding disposable cannulas and provide equipment vendor information so they can be re-ordered.

4.0.3 For the reusable cannulas, the cannula should be cleaned 1 to 3 times a day and more often if needed.

4.0.4 Do NOT leave the inner cannula out for more than 15 minutes.

4.1 EQUIPMENT

- ½ strength hydrogen peroxide
- Sterile water or normal saline
- Two clean containers or sterile containers (small bowl or cup)
- Inner cannula brush (tracheostomy brush or sterile pipe cleaner)
- Unfilled gauze pad

4.2 PROCEDURE

- Wash your hands.
- Explain the procedure appropriate for the adult and child’s age and understanding.
- Pour ½ strength hydrogen peroxide into a bowl or cup and normal saline or sterile water into the other container.
- Open the gauze pad
- Remove the inner cannula
- Place the inner cannula into ½ strength hydrogen peroxide and soak it for a few seconds and use the brush to clean secretions on the inside and outside of the cannula.
- Place the cannula into normal saline or sterile water solution, soak and rinse.
- Dry off excess water with clean or sterile gauze pad.
- Suction through the outer cannula if needed.
- Replace the inner cannula. Be sure the cannula is secure or “locked” in place in the trach tube.
- Wash your hands.

5.0 CUFFED TRACHEOSTOMY TUBES

5.1 Foam-filled Bivona cuff tracheostomy tube deflated (left), inflate (right)

5.2 A cuff is a soft balloon around the distal end of the tube that can be inflated to seal the trachea for children needing ventilator support or to help prevent secretions from entering the lungs.

5.3 Avoid over inflating the tracheostomy tube cuff. The pressure of the cuff against the wall of the trachea can cause damage if it’s too high. Two techniques that can be used to help avoid excess pressure are the minimal occluding volume technique and the minimal leak technique.

5.4 Suction the trach tube if needed.

5.4.1 After suctioning the trach tube, suction the mouth the mouth and above the trach cuff so that secretions do not go into the lungs when cuff is deflated.

6.0 CUFF DEFLECTION TECHNIQUES:

6.0.0 Minimal Occluding Volume Technique:

- Deflate the cuff, then slowly begin re-injecting air (or sterile water depending on the type of tube) with a luer lock syringe.

6.0.1 Place a stethoscope to the side of the child’s neck near the trach tube.

6.0.2 Inject air into the pilot line until you can no longer hear air going past the cuff.

6.0.3 This means the airway is sealed. For children that are totally ventilation dependent, provide breaths with manual resuscitator.

6.1 Minimal Leak Technique:

6.1.1 The same procedure as Minimal Occluding Volume, except that after the airway is sealed, slowly withdraw a small amount (approximately 1cc), so that a slight leak is heard at the end of inspiration.

6.1.2 Periodic measurements of the cuff volume should be noted and any changes reported to the doctor. A pressure manometer may be used to check cuff pressure on balloon filled with air.

6.1.3 Generally, cuff pressure should be below 25 cm H2O

7.0 HYPER-OXYGENATION:

7.1 Hyperoxygenate patient prior to suctioning, between catheter passes, and following completion of procedure.

7.1.1 The method selected should be determined by the patient’s status, type of airway and response to suctioning.

7.1.2 Deep Breathing:

a. Ask the patient to take 3 – 6 breaths initially.

b. Allow the patient to rest and re-oxygenate between suction passes.

c. Continue oxygen (if ordered) as much as possible during the procedure.

7.1.3 Manual Resuscitation Bag

a. Provide 3 – 6 large breaths with 100% oxygen via bag.

7.1.4 Ventilator Oxygenation

a. To be used with a Ventilator with option of 100% automatic cutoff otherwise use manual resuscitation bag.

- Increase ventilator FiO2 to 1.0 (100%).
- Allow 1-2 minutes
- Allow patient 3 – 6 breaths by ventilator

b. Be sure FiO2 is decreased to ordered level after suctioning.

- Use swivel adapter port closed system for patients ventilated with PEEP > 5cm so patient is not disconnected from the ventilator.

- If port closed system is not available, use a manual resuscitation bag with a PEEP adapter.
8.0 SUCTIONING

8.1 Tracheostomy or Ventilated Patient

8.1.1 Choose appropriate sized suction catheter. Diameter should be no larger than half the inside of any tracheal or endotracheal tube.

- **Portable**: F-15 cm H2O
- **Wall**: 80-120 mm Hg

8.1.2 Put on PPE (if indicated). Wash hands, put on gloves using sterile technique for suctioning.

8.1.3 Connect suction catheter to connecting tube maintaining sterility.

8.1.4 Unless contraindicated, place the conscious patient in semi-Fowler’s position to promote lung expansion and promote coughing.

8.1.5 Hyperoxygenate patient by one of the methods described above. Allow for re-oxygenation between attempts.

8.1.6 Instill 5-10 cc normal saline into E.T.T. or trach if needed to loosen secretions, stimulate cough or facilitate removal of secretions.

8.1.7 Using sterile hand with suction port open, insert catheter until area to be suctioned is reached or resistance is felt. (If resistance felt, withdraw catheter ½ inch as catheter could be touching carina.)

8.1.8 Suction intermittently by opening and closing suction port, rotating catheter 360 degrees as you quickly withdraw. This action captures more secretions and decreases trauma to tissues.

8.1.9 Apply suction for 5-10 seconds, if no signs of hypoxia.

8.1.10 **NEVER** suction for more than 10 seconds. Observe for signs of hypoxia, such as arrhythmia, bradycardia or decrease in peripheral tissue perfusion. **Stop immediately.** Oxygenate patient and document intolerance upon completion of procedure.

8.1.11 Flush catheter and tubing with normal saline.

8.2 Tracheostomy or Ventilated Patient

8.2.1 Lubricate catheter with water soluble jelly.

8.2.2 Consider use of nasal (trumpet) airway for repeated suctioning.

8.2.3 Advance the catheter through the nose anteriorly and medially to the back of nasopharynx.

8.2.4 Instruct patient to take a deep breath or cough as the suction catheter is advanced into the trachea.

8.2.5 Suction as described in section 8.1. to 8.1.6

8.3 Oral Suctioning

8.3.1 Wash your hands and wear gloves

8.3.2 Perform suction using clean technique.

8.3.3 Insert yankauer or suction catheter into mouth using sweeping motion to clear the sides of the mouth and back of throat.

8.3.4 Flush catheter, yankauer or tubing with normal saline.

9.0 DOCUMENTATION

9.1 Document in HealthTrust the following:

9.1.1 The number of times suctioned each shift

9.1.2 Estimated amount suctioned

9.1.3 Characteristics of secretions

9.1.4 Patient tolerance to procedure

9.1.5 Auscultation of breath sounds heard before/prior and after/post
PURPOSE:
To prevent and minimize bacterial growth in respiratory therapy equipment.

CONSIDERATIONS:
1. If not cleaned properly, respiratory therapy equipment provides an excellent reservoir for growth of pathogenic organisms that can be introduced to the patient via the airway.
2. If the patient experiences an upper respiratory infection, nasal prongs and face masks should be changed once symptoms are controlled.
3. Scrupulous attention should be given to all parts of the equipment (i.e., exterior, tubing, reservoirs, etc.).
4. Equipment should be rinsed in warm running water after each treatment and disinfected daily.
5. Two complete sets of washable equipment should be on hand so that a clean, dry set is available if needed.
6. DO NOT use hair dryers and blowers to dry equipment, let equipment air-dry.
7. All equipment should be kept in a clean, dry, dust-free area.
8. Humidification bottles should be washed with soap and warm water, rinsed thoroughly between refills.

EQUIPMENT:
Liquid dish detergent
Nylon brush
Clean, dry towel or paper towels
Disinfecting agent
Basin
Plastic bag, if equipment is to be stored
Gloves
Personal protective equipment, as needed

PROCEDURE:
1. Adhere to Standard Precautions.
2. Remove all washable parts of equipment and disassemble.
3. Wash equipment in liquid dish detergent and hot water, scrubbing gently with a nylon brush. Scrub thoroughly to remove mucus, secretions, medications and foreign material.
   Oxygen Concentrator:
   Clean at least once a week. The outside of the concentrator can be wiped down with a clean damp cloth and a mild dish detergent. Never spray cleaner directly onto the machine. Concentrator may have exterior filters that need to be changed at least once per week. Filters can be removed and placed under warm running water. Excess water should be wrung out and the filters should be left to air dry.
   Cannula: Clean daily with mild dish detergent and rinse. Replace every 2 weeks.
   Tubing: Replace monthly
   Water Trap: Empty as needed. Remove at least twice a week and clean with mild dish detergent and rinse
   Humidifier Bottle: Use only distilled or sterile water. Empty daily and replace with new distilled water or sterile water. Clean and disinfect at least twice a week. First wash with mild detergent and rinse well; then soak in 1 part water and 1 part distilled white vinegar. Rinse thoroughly and allow to air dry.
   Yankhauer/Suction Tubing:
   After suctioning patient, suction clean water to avoid buildup/obstruction. At the end of the day, after cleaning with water, suction a soap and water mixture through the equipment to clean. At least twice weekly, after performing above, suction a solution of 10% white distilled vinegar/90% water. Vinegar/water solution should remain in tubing for 30 minutes to disinfect. Replace suction equipment, tubing, canister weekly.
4. Rinse equipment thoroughly, making sure all detergent is removed.
5. Soak equipment in disinfecting agent or other disinfecting agent recommended by equipment manufacturer.
6. Rinse equipment parts, using sterile or filtered water for the final rinse.
7. Air dry equipment by:
   a. Shaking or swinging excess water out of tubing and hard to dry areas.
   b. Hanging tubing to drip-dry completely.
   c. Placing remaining equipment on clean paper towels and covering with paper towels.
8. Discard solution according to manufacturer's instructions.
9. Wipe down all surfaces of machines with a clean cloth daily.
10. Store unused equipment in plastic bag.

AFTER CARE:
1. Document in patient's record:
   a. Instructions given to patient/caregiver.
   b. Patient/caregiver understanding and return demonstration.
   c. Condition of equipment after cleaning.

REFERENCES:
PURPOSE:
To prevent infection and skin breakdown of the tracheostomy and surrounding tissues.

CONSIDERATIONS:
1. Generally in homecare, tracheostomy care is a clean procedure. If tracheostomy is new (within 4 to 6 weeks) or patient is immuno-compromised, sterile technique should be used.
2. It is recommended that suctioning equipment be kept available for an emergency, especially for patients with new tracheostomy tubes or when the patient’s condition requires suctioning to control secretions.
3. Cleaning the inner cannula:
   a. If communication is impaired, an alternate system of communication should be established.
   b. Keep extra sterile tracheostomy tube and obturator on hand in case of accidental expulsion of the tube or blocked tube.
   c. Prevention of complications in the patient with a tracheostomy should include assessment for:
      (1) Tube displacement leading to inadequate air exchange, coughing and/or vessel erosion.
      (2) Subcutaneous emphysema.
      (3) Pneumothorax.
      (4) Stomal infection.
      (5) Amount, color, consistency and odor of secretions.
      (6) Collection of secretions under dressing, bibs, or twill tape, which will promote infection.
      (7) Occlusion of cannula.
      (8) Tracheal erosion.
      (9) Lower respiratory infection.
   d. Tracheostomy cleaning may need to be performed more frequently when the tracheostomy is new. The healed tracheostomy may be cleansed less frequently if few secretions and encrustations are present.
   e. The use of powder, oil-based substances or dressings cut to fit around stoma is contraindicated due to danger of aspiration.
   f. Soft cuffs should be inflated to a minimally occlusive volume to reduce the risk of tissue necrosis.
4. Changing the tracheostomy ties:
   a. Tracheostomy ties stabilize the tracheostomy tube and prevent accidental expulsion from trachea.
   b. Length of ties depends on neck size. The neck may change in size due to swelling and/or changes in body position. Ties should be examined frequently to insure proper tension. Ties that are too loose will allow expulsion of the tube; too tight causes necrosis, circulatory and respiratory impairment. Tight or crooked ties could lead to malpositioning of the tracheostomy tube and subsequent tracheal erosion. You should be able to slip only one or 2 fingers between the collar and the neck.
   c. Alternate securing the knot to the right and left side of the neck to avoid irritation.
   d. Velcro tracheostomy holder should be changed if soiled.
5. Changing and cleaning the tracheostomy button/plug:
   a. Buttons and plugs are used as the last stage to wean the patient from tracheostomy. It consists of a short tube that fits the stoma and reaches the trachea and a solid cannula that closes the tube. The plug fits directly into the stoma and into the trachea and usually does not require ties to hold it in place.
   b. Recommended time of cleaning is mornings upon awakening at least twice a week and PRN. Early morning secretions are usually the most viscous.
   c. Always inspect the clean button, cannula or plug for defects, especially the "petals" at the cannula’s proximal end.
6. Many masks/mouthpieces distributed for protection while performing artificial respiration are not adaptable for use with a tracheostomy tube. When a patient has a tracheostomy tube and has not been designated as do not resuscitate, special equipment such as a manual resuscitator or a mask/mouthpiece, which can be used with a tracheostomy tube, should be available to protect the nurse if artificial ventilation is needed.
7. Metal tubes can be cleaned and reused. Clean metal tubes with soap and water using pipe cleaners, and making sure to rinse well. Using a pan specifically used for tracheostomy tubes, boil tube parts for 15 minutes. Drain water; allow metal parts to cool and to air dry. Then, place in sterile container. DO NOT leave metal tubes soaking for long periods of time as this causes pitting of the metal.

EQUIPMENT:
Gloves goggles/mask with eyeshield and other personal protective equipment (PPE), as needed
Suction catheter
Sterile normal saline or distilled water
4x4 gauze sponges
Stethoscope
Hemostat
Second tracheostomy tube and obturator
3 small bowls
Measuring tape
Suction machine
Impervious trash bag
Respiratory – Cleaning Inner Cannula

SECTION: 9.05

Strength of Evidence Level: 3

Hydrogen peroxide
Cotton-tipped applicators
Bandage scissors
5-10 mL syringe for cuffed tracheostomy tube
Small nylon bottlebrush and/or pipe cleaner
Trachostomy tube pan
Twill tape or velcro ties

FOR TRACHEOSTOMY BUTTON/PLUG
- Clean button and cannula or clean plug
- Hydrogen peroxide
- Small bottle brush or pipe cleaner
- Gloves and other PPE, as needed
- Water-soluble lubricant
- 4x4 precut unfilled gauze tracheostomy dressings
- Clean plastic bag

PROCEDURE:
1. Adhere to Standard Precautions.
2. Explain procedure to patient.
3. To clean the inner cannula (nonmetal):
   a. Prepare equipment.
      (1) Place impervious trash bag near work site.
      (2) Create a clean field for equipment.
      (3) Pour hydrogen peroxide in one container.
      (4) Pour distilled water or saline into second container.
      (5) Pour distilled water or saline into third container into which 4x4 sponges are placed for cleaning encrustations.
      (6) Prepare new tracheostomy ties for replacement, if soiled.
   b. Place patient in semi-Fowler’s position.
   c. Remove oxygen, ventilation or humidification devices.
   d. Suction patient.
   e. Return patient to oxygen or ventilator to allow rest period before continuing care.
   f. Remove old tracheostomy bib or dressing and discard.
   g. Remove and discard contaminated gloves. Wash hands.
   h. Put on clean gloves.
   i. Using presoaked 4x4 sponge and damp applicators, gently wash skin around stoma, under tracheostomy ties, and flanges. Wipe only once with each sponge or applicator and discard.
   j. Clean inner cannula:
      (1) Unlock and remove inner cannula.
      (2) Place inner cannula in hydrogen peroxide and allow soaking to remove encrustation.
   (3) Using nylon brush or pipe cleaners, gently scrub inner cannula.
   (4) Rinse cannula with normal saline or distilled water. Shake off excess solution.
   (5) Examine cannula for patency; if not clean, repeat cleansing process.
   (6) Re-insert clean inner cannula in tracheostomy tube and lock securely into position.
   k. Assess patency of airway, position of the tube and patient’s respiratory status.
   l. If applicable, reconnect patient to oxygen, ventilator or humidification.
   m. Apply new tracheostomy bib or dressing.
   n. Tighten tracheostomy ties, if too loose. Replace old ties, if soiled.
   o. Discard soiled supplies in appropriate containers.

4. Changing the tracheostomy ties:
   a. Adhere to Standard Precautions.
   b. Explain procedure to patient.
   c. Prepare twill ties according to method selected:
      (1) Double strand tie method: Cut two lengths of 20 inches twill tape.
      (2) Single strand with slit ties: Cut two lengths of twill tape, one 10 inches, one 20 inches. Fold back one inch and cut small slit, repeat with second tie.
      (3) Single strand with knot: Cut two lengths of twill tape 20 inches each. Tie large knot in end of each strand.
   d. With patient in semi-Fowler’s position, remove the old ties by untying or cutting and discard.
   e. Examine neck for skin breakdown.
   f. Change ties according to method selected:
      (1) Double strand tie method: Thread through hole in tracheostomy tube flange. Approximate ends; repeat with second tie.
      (2) Single strand with slit ties: Thread slit end through underside of tracheostomy and then, thread the other end of tie completely through slit ends and pull taut so it loops firmly through tube’s flange.
      (3) Single strand with knot: Thread unknotted end of tie through tracheostomy tube flange hole.
   g. Bring both ends of ties to right or left side of neck and secure.
   h. Evaluate tapes for snugness. Tie should be loose enough to admit one finger underneath.
   i. Cut off excess tape.

5. Changing/cleaning the tracheostomy button or plug:
   a. Adhere to Standard Precautions.
   b. Explain procedure to patient.
c. With patient in sitting position, cleanse the area around the stoma using distilled water and a 4x4 gauze.

d. Remove button, cannula or plug carefully using an out and down pull.

e. Inspect skin area around stoma for any breakdown or any type of irritation.

f. If using a button, lubricate clean cannula with water-soluble lubricant and insert button into cannula as far as it will go. If using a plug, lubricate and insert gently.

g. Check fit by pulling gently outward. If inserted correctly, it will remain in stoma.

h. Clean button cannula or plug by soaking in hydrogen peroxide and cleaning with small bottlebrush or pipe cleaner.

i. Rinse with water, allow to air dry and store in clean, covered jar or plastic bag.

j. Discard soiled supplies in appropriate containers.

AFTER CARE:

1. Clean reusable equipment and suction machine. 
   (See Cleaning and Disinfection of Respiratory Equipment.)

2. Document in patient's record:
   a. Procedure performed and time.
   b. Quality and quantity of suctioned secretions.
   c. Drainage, color, odor and quantity of drainage on dressing.
   d. Condition of stoma and surrounding skin.
   f. Instructions given to patient/caregiver.
   g. Patient/caregiver understanding of instructions.

RESOURCES:

Aaron’s Tracheostomy Page Cleaning Equipment 1996-2010
http://www.tracheostomy.com/faq/equipment/index.htm


PURPOSE:
To increase expectoration of sputum by learning to control the cough in an effective manner.

CONSIDERATIONS:
1. Vibration, percussion, postural drainage and coughing all increase expectoration of sputum. The primary function of the cough is to expectorate secretions and foreign material from the airways.
2. Educating the patient with an ineffective cough, e.g., chronic, paroxysmal, hacking cough, to a controlled, effective cough requires training and practice. Stress is placed on minimizing the forcefulness of the cough and in using diaphragmatic breathing between coughs.
3. Controlled coughing should make a hollow sound. The first cough in the procedure loosens; the second cough moves the mucus. The momentary stopping and starting of inspired air (sniffing) prevents triggering the coughing mechanism.
4. The most comfortable position for coughing is in a sitting position with head slightly forward, feet on the floor.
5. The cough procedure should become a routine part of the patient's chest physical therapy.

EQUIPMENT:
- Tissues/paper towels
- Impervious trash bag
- Gloves
- Mask, protective eye wear (optional)

PROCEDURE:
1. Adhere to Standard Precautions.
2. Explain procedure to patient, reviewing diaphragmatic and pursed-lip breathing.
3. Position the patient in a forward leaning posture, feet on floor, tissues in hand.
   a. Instruct the patient to do the following:
      (1) Slowly inhale through your nose.
      (2) Hold the deep breath for 2 seconds.
      (3) Cough twice with mouth slightly open. Use strong tissues or paper towels to dispose of mucus. Deposit used tissues/towels in impervious bag.
      (4) Pause.
      (5) Inhale by sniffing gently. This gentle breath helps prevent mucus from moving back down the airways.
      (6) Rest.
   b. Have the patient practice the procedure, then write down the steps, if a printed handout is not available.
4. Discard soiled supplies in appropriate containers.

AFTER CARE:
1. Document in patient's record:
   a. Length and time spent on cough training.
   b. Color, amount, odor and viscosity of sputum.
   c. Instructions given to patient/caregiver.
   d. Patient’s response and ability to give a return demonstration of procedure.

REFERENCE:
Purpose:
To care for the Heimlich Valve which allows air to flow out of the chest.

Considerations:
1. Do not disconnect valve from tubing.
2. Make sure ends are properly connected.
3. Do not put lotions, creams or powders around insertion site.
4. Valve fluttering or noises are normal. Also seeing air or fluids pass through the valve is normal.
5. Do not clamp valve unless told by physician.

Equipment:
- Clean cloth
- Gloves
- Skin prep or barrier
- Soap and water
- Tape
- 4x4 Gauze drainage sponge
- 4x4 Gauze sponge

Procedure:
1. Wash hands and be sure to adhere to Standard Precautions.
2. Remove old dressing and inspect the insertion site for signs of infection.
3. Be sure to cleanse site with soap and water. Make sure to rinse well and pat dry with a clean, dry cloth. Apply a skin barrier to surrounding tissue to avoid irritating due to repeated tape exposure, if necessary.
4. Cover with 4x4 drainage sponge and tape. For added protection cover with 4x4 gauze sponge.
5. Tape the valve to the skin below the insertion site. This is done so fluid does not reenter the chest at the insertion site.
6. Wash hands after procedure is completed.

Aftercare:
2. Document and describe drainage, if any. Also be sure to document patient’s tolerance for the procedure and skin appearance around the insertion site.
3. Contact physician with any changes.
4. Instruct patient and caregiver with emergency measures if the tube falls out.

Resources:
Heimlich (Flutter) Valve Care. Visiting Nurse Services and Hospice. Hackley.
Respiratory – History and Assessment

SECTION: 9.08

Strength of Evidence Level: 3

PURPOSE:
To identify areas requiring intervention while establishing a baseline for measuring improvement or deterioration in condition of patient.

CONSIDERATIONS:
1. Key elements of a comprehensive respiratory assessment include a patient history followed by inspection and examination of the patient.
2. The physical examination involves inspection, palpation, percussion and auscultation.
3. Common symptoms of lung problems include dyspnea, orthopnea, apnea, bradypnea, tachypnea, hyponea, hypernea, Cheyne-stokes respirations, cough, chest pain, fever or blood in the sputum.
4. OASIS items identify the level of exertion/activity that results in a patient’s dyspnea or shortness of breath.

EQUIPMENT:
Personal protective equipment, as indicated.
Stethoscope
Pulse oximeter

PROCEDURE:
1. Patient history obtained through review of documentation from referring entity and interview of patient and/or family members.
   b. Cough: productive versus non-productive.
   c. Past medical history:
      (1) Chief complaints.
      (2) Previous hospitalizations for similar complaints.
      (3) Symptoms and when they started.
      (4) Medications currently prescribed for problem.
      (5) Allergies.
      (6) Relevant work history.
      (7) Asthma.
      (8) Smoking: pack years=number of packs/day x number of years
2. Inspection of the patient: A comprehensive visual assessment that provides a baseline for measuring improvement or deterioration in condition.
   b. Level of consciousness.
   c. Vital signs.
   d. Examination of the head.
   e. Examination of the neck.
   f. Examination of thorax and lungs:
      (1) Thoracic configuration - barrel chest often indicates chronic lung disease.
      (2) Breathing pattern and effort.
      (3) Retractions.
      (4) Synchrony of diaphragm and upper chest
      (5) Abdominal paradox: predictor of impending respiratory failure.
3. Palpation: The art of touching the chest wall to evaluate underlying structures.
   a. Skin and subcutaneous tissues: crepitus.
   b. Pain.
   c. Tactile fremitus.
   d. Thoracic expansion.
4. Percussion of the chest: Act of tapping on the chest wall to evaluate underlying structures.
   a. Percussion sounds:
      (1) Dull indicates fluid or increased tissue density.
      (2) Hyperresonant (hollow) or tympany indicates increased air.
      (3) Resonance over normal lung tissue.
      (4) Flat over massive pleural effusion of atelectasis.
5. Breathing patterns:
   a. Cheyne-stokes: Irregular patterns of deep breathing followed by periods of shallow breathing and usually ending with a period of apnea.
   b. Biot’s breathing: Irregular patterns of breathing, usually very disorganized.
   c. Kussmaul’s breathing: Rapid and deep breathing.
   d. Apneustic pattern: Prolonged inspirations, serial inspirations without exhalation after each, followed by a ‘summative’ exhalation.
   e. Asthmatic pattern: Excessively long expiratory periods.
   f. Paradoxical breathing: Present when a portion of chest wall moves in the opposite direction as it should during the breathing cycle. Seen especially in infants who have a very pliable chest. Indicates respiratory distress.
6. Auscultation: Listening to breath sounds.
   a. Stethoscope:
      (1) Bell for low pitch sounds (heart sounds).
      (2) Diaphragm for higher pitched sounds (breath sounds).
   b. Optimal technique:
      (1) Patient breathes through his/her mouth.
      (2) Sounds on one side of the chest should be compared to the opposite side.
      (3) May be necessary to have the patient sit up or roll from side to side.
      (4) Place stethoscope under clothing onto bare skin.
c. Normal breath sounds:
   (1) Vesicular: Soft ‘rustling’ sounds heard over most lung tissue.
   (2) Bronchovesicular: Heard only over major airways.
   (3) Tracheal: Hollow tubular sounds.

d. Abnormal (adventitious) breath sounds:
   (1) Crackles (rales): Discontinuous ‘pop-like’ sounds generally heard on inspiration that are indicative of atelectasis, bronchitis, pneumonia, pulmonary edema or pulmonary fibrosis.
   (2) Wheezes: High-pitched continuous musical sounds that can be heard on both inspiration and exhalation.
   (3) Rhonchi: Low-pitched shoring sound that is continuous and can be heard on inspiration or exhalation. Can clear with cough or suctioning. It is usually indicative of secretions in many conditions and in COPD, can indicate air flow obstruction unrelated to secretions.
   (4) Bronchial breath sounds: Tracheal sounds heard over lung parenchyma.
   (5) Stridor: High-pitched raspy sound heard at it’s loudest over the trachea. Indicates upper airway narrowing or obstruction and can be heard in conditions such as post extubation stenosis and croup.
   (6) Pleural friction rub: Clicking or grating sound caused by friction that is produced as the parietal and visceral pleura rub against each other during breathing. Can be heard in some types of pneumonia.
   (7) Egophony: “e” to “a” changes. Indicative of density or fluid consolidation.

REFERENCES:


AFTER CARE:
1. Report findings to physician.
2. Document in patient’s medical record:
   a. Instructions given to patient and/or caregiver.
   b. Communication with physician.
   c. Coordination with other disciplines.
PURPOSE:
To optimize lung function and prevent respiratory complications.

CONSIDERATIONS:
1. An incentive spirometer is a device used to measure how much air can go into the lungs.
2. An incentive spirometer is made up of a tube, an air chamber and an indicator.
3. An incentive spirometer is commonly used in those who are at risk of having airway or breathing problems. Patients with lung diseases may improve their lung function by using an incentive spirometer.
4. The incentive spirometer also will help keep the lungs active when a person is recovering from surgery.

EQUIPMENT:
Incentive spirometer

PROCEDURE:
1. Adhere to Standard Precautions.
2. Instruct the patient to perform the following:
   a. Sit up with head and neck centered.
   b. Hold incentive spirometer in an upright position.
   c. Place the target pointer to the level that is needed to reach the desired level.
   d. Exhale normally.
   e. Place the mouthpiece in mouth with lips tightly sealed around it.
   f. Inhale slowly and deeply through the mouthpiece to raise the indicator, attempting to make the indicator rise up to the level of the target pointer.
   g. When unable to inhale any longer, remove mouthpiece and hold breath for approximately 2 to 6 seconds.
   h. Exhale normally. Encourage patient to cough after each repetition, if secretions are present.
3. Repeat these steps 5 to 10 times every hour when awake, or as often as healthcare provider has advised.
4. After each use, clean the mouthpiece with water and shake it to dry.
5. Keep track of progress by writing down the highest level able to reach.

AFTER CARE:
1. Document in patient's record:
   a. Instructions given to patient/caregiver.
   b. Patient/caregiver understanding and return demonstration.

REFERENCES:
PURPOSE:
To monitor arterial oxygen saturation non-invasively.

CONSIDERATIONS:
1. The symbol SpO2 is used to denote non-invasive, electronically measured arterial oxygen saturation. The symbol SaO2 is used to indicate invasively measured arterial oxygen saturation.
2. Oximetry measures the percentage of hemoglobin that is saturated with oxygen. If the patient is anemic (not enough hemoglobin), the SpO2 may be within normal limits but the blood may not be carrying enough oxygen to meet the tissue oxygen needs. In this situation, the patient could appear hypoxic with a "normal" SpO2 value.
3. Oximetry gives no information about the level of blood carbon dioxide (CO2). Patients can have hypercarbia with normal oxygen saturation.
4. The SpO2 value must always be interpreted in the context of the patient's complete clinical care.
5. Preferred probe sites for adults and children are fingertips and earlobes. Acceptable sites for infants include fleshy portion of hand, fleshy portion of foot, or toe. For neonates, the ball of the foot or heel of the hand are the best sites.
6. Results may be inaccurate if the patient has any of the following:
   a. Conditions which cause poor perfusion to probe site:
      (1) Low cardiac output
      (2) Vasoconstriction
      (3) Hypothermia
   b. Elevated carboxyhemoglobin levels.
   c. Elevated methemoglobin levels.
   d. Artificial nails or nail polish.
7. If unable to remove nail polish or artificial nails, place the probe sideways so the light goes through the fingernail side to side and bypasses the nail.
8. Other causes of inaccurate results include:
   a. Excessive ambient light sensed by the probe sensor.
   b. Patient movement.
   c. Inability of oximeter to accurately sense the patient's pulse.
9. Patient should be in a "steady state" on correct dose of oxygen (or off oxygen) for at least 15 minutes before obtaining a reading. If initial reading done on oxygen, then with oxygen off, the nurse must wait at least 15 minutes after oxygen removed to obtain accurate room air reading.
10. If the patient shows clinical signs of distress after oxygen removal, immediately replace the oxygen at the appropriate liter flow.
11. For infants and neonates, clarify with physician if oximetry reading needs to be done during a feeding session, during sleep or during awake/active times.
12. Normal SpO2 levels are 95-100% at sea level, lower with higher altitudes (e.g. 90% or greater at 1 mile above sea level).

EQUIPMENT:
Oximeter
Finger or ear probe
Alcohol wipes
Nail polish remover (if needed)

PROCEDURE:
1. Adhere to Standard Precautions.
2. Verify physician's order for procedure.
3. Explain procedure to patient.
4. Prepare equipment according to manufacturer's instructions.
5. Ensure patient has been on correct dose of oxygen for at least 15 minutes prior to obtaining reading.
6. Select probe site appropriate for age and condition of patient.
7. Place probe so sensors are opposite of each other. For ear lobe, gently massage site for about 10 seconds prior to probe application.
8. Turn on pulse oximeter. The unit will perform a self-check, then the pulse indicator should flash synchronously with the patient's pulse. If the pulse is not sensed accurately, the SpO2 value will be inaccurate.
9. Read SpO2 value after several minutes when reading stabilized.

AFTER CARE:
1. Remove probe, turn off and unplug unit. Clean the probe gently with alcohol wipe.
2. Document in patient's record:
   a. Procedure type.
   b. Date and time.
   c. Probe location.
   d. O2 type and concentration, if in use.
   e. Patient activity.
   f. SpO2 reading.
   g. Action taken, if any.
   h. Patient's response to procedure.
PURPOSE:
To instruct the patient/caregiver in the correct usage of a metered dose inhaler (MDI) for the effective delivery of inhaled medications.

CONSIDERATIONS:
An MDI gives one dose of medicine with each puff. The inhaler must be used correctly to effectively deliver the medicine into the throat and lungs. If used incorrectly, the medicine may be left on the tongue and back of oral cavity.

EQUIPMENT:
Inhaler
Spacer (optional)

PROCEDURE:
1. Adhere to Standard Precautions.
2. Instruct the patient to perform the following;
   a. Shake the inhaler 5 or 6 times.
   b. Remove the mouthpiece cover.
   c. If using a spacer, place it over the mouthpiece at the end of the inhaler.
   d. Put your lips and teeth over the mouthpiece/spacer being careful not to block the mouthpiece with your tongue.
   e. Breathe in slowly. As you do so, squeeze the top of the canister once. (If using a spacer, squeeze the top of the canister first, and then breathe in slowly.)
   f. Keep inhaling even after you finish the squeeze.
   g. Continue inhaling slowly and deeply.
   h. After inhaling, remove the mouthpiece/spacer from your mouth and hold your breath for up to 10 seconds.
   i. If you need another dose of medication, repeat the previous steps.
   j. Replace the mouthpiece cover and store equipment.
   k. Rinse your mouth and gargle with water, spit out, DO NOT swallow.
3. Clean Equipment. (See Respiratory - Cleaning and Disinfection of Respiratory Therapy Equipment)

AFTER CARE:
1. Document in patient's record:
   a. Instructions given to patient/caregiver.
   b. Patient/caregiver understanding and return demonstration.

REFERENCE:
Respiratory – Nursing Management of the Ventilator-Dependent Patient In The Home 
SECTION: 9.12
Strength of Evidence Level: 3

PURPOSE:
To safely maintain the ventilator-dependent patient in a home setting through comprehensive nursing assessment and intervention.

CONSIDERATIONS:
1. Mechanical ventilation is never used on a patient with unresolved pneumothorax.
2. The medical equipment supplier is expected to provide/ensure that:
   a. A respiratory therapist is available 24 hours per day.
   b. Electrical equipment is properly grounded. Extension cords are not acceptable unless approved by the manufacturer or supplier.
   c. A back-up ventilator and suction unit should be in the home. Judgement may be used to determine if a back-up ventilator is necessary. Some factors which should be considered are:
      (1) Patient’s degree of dependence on mechanical ventilation.
      (2) Skill and reliability of caregivers.
      (3) Proximity/accessibility of equipment supplier.
   d. Only equipment recommended by the manufacturer is used.
   e. Any defective equipment is replaced in a timely manner.
   f. A manual resuscitation bag is maintained in the home.
   g. Instructions are placed in the home for use, maintenance and emergency measures in case of mechanical or power failure.
   h. Education to the patient/caregiver regarding use and maintenance of equipment and safety measures.
3. Oxygen precautions must be observed.
4. The patient is never ventilated with dry gas.
5. The ventilator tubing must be kept free of condensation.
6. Proper cleaning of equipment reduces the risk of infections.
7. A system of communication should be established with the patient.
8. Potential medical complications requiring observation and reporting are:
   a. Airway obstruction.
   b. Tracheal damage.
   c. Pulmonary infection.
   d. Pneumothorax.
   e. Subcutaneous emphysema.
   f. Cardiac instability.
   g. Atelectasis.
   h. Gastrointestinal malfunction.
   i. Renal malfunction.
   j. Central nervous system malfunction.
   k. Psychiatric trauma.
9. Mechanical ventilation for the patient is initiated in the hospital. Criteria for homecare of the ventilator dependent patient includes:
   a. A willing and able patient and caregiver(s).
   b. Demonstrated capabilities of both patient and caregiver(s).
   c. A plan for 24 hour availability of caregiver(s).
   d. A home appropriate for the ventilator dependent patient:
      (1) Adequate space for placement of the equipment.
      (2) Water.
      (3) Electricity.
      (4) Telephone service.
      (5) Clean environment.
   e. A plan for periodic medical care and laboratory studies.
   f. Funding source(s) for professional services, supplies and equipment.
   g. Back-up emergency equipment and source of electricity.
10. Prior to hospital discharge, careful planning is necessary to return the ventilator-dependent patient to the home setting.
   a. Patient should be medically stable, secure artificial airway, adequately oxygenated with < 40% FiO2, and maintain adequate ventilation on standard ventilator settings.
   b. The patient should be using the same type of ventilator in the hospital as ordered for homecare.
   c. The homecare nurse should make a hospital visit to meet the patient and participate in the care planning process with the multidisciplinary hospital team.
11. Preparing for the first day at home includes all the considerations unique to the ventilator-dependent patient. Special planning is required to transport the patient home with portable ventilator equipment. Prior to attaching the patient’s airway to the home ventilator, all systems must be carefully checked per manufacturer’s directions.
12. All essential equipment including oxygen source must be in home when patient arrives.
13. Local emergency contacts should be listed for patient/family.
14. Letters should be sent to telephone and local electrical companies notifying them that patient should be on the priority reconnect list. Emergency Medical Systems should be contacted.

EQUIPMENT:
Portable ventilator with alarms
Adequate power source
Cascade heating elements
Humidifying system
Breathing circuit tubing and hose assemblies
Supplemental oxygen source
Main hose
Tracheal tube adapters
Exhalation valve
Flex tubing
Suction unit and equipment
Two 12-volt leak-proof batteries, cases and cables
One 8-hour capability
One 6-hour capability
Battery recharger
Non-sterile gloves
Obturator
Tracheal tubes with cuff
Tracheostomy care kit (optional)
Sterile wrap
Basins (3)
Forceps
Drape
Flexible nylon bristle brush
Pipe cleaners (3)
30" twill tape or velcro ties
Gauze sponges (4)
Precut non-woven trach dressings (3)
Sterile gloves
Sphygmomanometer
Stethoscope
Normal saline solution
Hydrogen peroxide
Sterile distilled water
Disinfectant
Manual resuscitation bag, required for portability and power failure
Daily checklist for caregiver(s)
Weekly checklist
Oxygen (if required)
Back-up ventilator (optional)
Nebulizer unit (if ordered)
In-line adapter to ventilator circuit or Pulmo-Aid unit
Surge protector
Medication
Communication means

**PROCEDURE:**
1. Adhere to Standard Precautions.
2. Don any necessary protective equipment.
3. Explain procedure to patient.
4. Review physician's order:
   a. Ventilator type.
   b. Ventilator rate.
   c. Ventilation mode (e.g., intermittent mandatory ventilation (IMV), synchronized intermittent mandatory ventilation (SIMV), assist/control).
   d. Tidal volume.
   e. Fraction of inspired oxygen concentration.
   f. Sigh rate, sigh volume if applicable.
   g. Oxygen tension setting (PEEP).
   h. Low and high pressure alarm settings.
   i. Duration of treatment.
   k. Flow rate (optional).
   l. Medication and diluent (optional).
5. Evaluate pulmonary status:
   a. Check home ventilator to determine that all settings are per physician's orders, connections and tubing are intact.
   b. Evaluate patient's pressure reading for normal values.
   c. Assess patient for symmetrical chest expansion.
   d. Auscultate lung fields.
   e. Suction trachea as needed to maintain an open airway. *(See Respiratory - Tracheal Suctioning,)*
   f. Provide routine tracheostomy care. *(See Respiratory - Tracheostomy Care,)*
   g. Provide periodic sighing or deep breathing with ventilator mechanism or manual resuscitation bag.
   h. Check humidification system to ensure patient is never ventilated with dry gas.
   i. Keep tubing free of condensation.
   j. Monitor and record level of oxygen in tank.
   k. Check that back-up ventilator and batteries are in home and operational.
   l. Check and test alarm limits.
6. Evaluate gastrointestinal status:
   a. Auscultate bowel sounds.
   b. Palpate abdomen.
   c. Measure abdominal girth.
   d. Monitor bowel functioning.
7. Evaluate cardiovascular status:
   a. Auscultate heart sounds.
   b. Assess for jugular neck vein distention.
   c. Observe for peripheral edema.
   d. Monitor blood pressure and pulse.
8. Evaluate fluid balance:
   a. Assess intake and output.
   b. Assess skin turgor and mucous membranes for signs of dehydration.
9. Evaluate nutritional status:
   a. Assess oral intake.
   b. Observe for possible dysphagia and/or aspiration.
10. Assess for signs/symptoms of infection:
    a. Monitor temperature.
    b. Observe for increases in heart rate.
c. Observe for changes in tracheal secretions.
11. Identify and establish methods of communication.
12. Assess adequacy of rest/sleep periods:
   a. Instruct patient/caregiver to schedule activities to allow patient adequate rest/sleep periods.
   b. Instruct patient/caregiver in relaxation techniques.
15. Clean ventilator equipment. *(See Respiratory - Cleaning and Disinfection of Respiratory Equipment.)*
16. Reassemble equipment.
17. Discard soiled supplies in appropriate containers.

**AFTER CARE:**
1. Document in patient's record:
   a. Nursing assessment.
   b. Operation of home ventilator system including alarms.
   c. Caregiver's ability to meet patient's needs.
   d. Instructions to patient/caregiver.
   e. Patient/caregiver returns demonstration responses.
   f. Communication with physician, medical equipment supplier and respiratory therapist.
   g. Patient/caregiver coping strategies with the plan of care.
Respiratory – BLANK

Strength of Evidence Level: Blank
COMPREHENSIVE RESPIRATORY ASSESSMENT

1. Before touching the patient verify Name and Date of birth

The Nurse needs to know the “five rights” - the right patient, with the right medicine, right dosage, at the right time and the right route of administration

Completed

2. Describe the sorts of things one can assess initially in your upon looking at the patient.

The observant therapist can start assessing from the doorway upon walking into the room. Is the situation safe? Is the patient on his/her oxygen? What is the respiratory rate? What is the respiratory breathing pattern? Has the patient any obvious signs of hypoxia and SOB.

3. List and describe the information you would obtain from your initial impression before you start your therapy.

You would document the patient’s respiratory rate and effort. What is the amount, if any, of the oxygen administration device? What is the patient’s position during therapy?

5. Describe how you would evaluate whether cyanosis is present.

The signs of cyanosis are characteristic of hypoxia. They are tachypnea with increased accessory muscle use. Tachycardia as the heart tries to compensate. The patients’ nail beds and mucous membranes will have a bluish tinge. Often the patient is complaining of Dyspnea is restless and disorientated. They are often confused with impaired judgment and uncoordinated. Often patients are not arouseable and somnolent approaching a coma-like state.

6. Describe how you would evaluate for the presence of jugular venous distension (JVD) and the pathophysiological significance of JVD.

Jugular Vein Distension is part of the inspection and palpation of the neck. A patient usually is seen as “bulging veins” in his neck. The most common cause for this is (Cor pulmonale) right-sided heart failure. This sometimes occurs due to long time pulmonary constriction involved with chronic hypoxia.

7. List and describe other abnormalities that may be seen by inspection of the head and neck.

The respiratory therapist can learn a lot from looking closely at the patient’s head. The patient’s face should be inspected for nasal flaring (especially in infants), cyanosis of the mucosa around the mouth and pursed-lip breathing. Watch for facial expression with alertness, fear and distress.

The physician inspects and palpates the trachea in the neck area. If the trachea is shifted to one side or the other it may be a symptom of a tension pneumothorax or massive atelectasis. The trachea will shift away from the tension ‘pneumo’ and toward the atelectasis.
8. List the four elements that make up the physical examination of the chest.

The examination of the chest involves:
   a. Inspection (looking)
   b. Palpation (feeling)
   c. Percussion (tapping)
   d. Auscultation (listening)

9. Review the topographical lines on the thorax used to pinpoint the location of abnormal findings in the thorax.

Typical anatomical lines or planes include:
   a. Frontal plane (divides front to back)
   b. Transverse plane (divides top and bottom)
   c. Sagittal plane (divides right from left)
   d. Supine (lying on back - face up)
   e. Prone (lying on stomach - face down)
   f. Superior – inferior; anterior – posterior; proximal – distal; medial – lateral; superficial – deep
   g. Midline; midsternal, midclavicular line; mid-axillary line
   h. Four abdominal quadrants; right + left upper, right and left lower

10. Review the locations of the fissures and lung lobes and segments in relation to chest wall landmarks.

   **Anterior**
   Top of lungs – is 2-4 cm above middle of clavicles
   Suprasternal notch – is top of manubrium
   Sternal angle (Angle of Louis) – articulate of 2nd rib and bifurcation of trachea
   Bottom of lungs – 6th rib midclavicular and 8th rib midaxillary (at end of exhalation)

   **Posterior**
   C-7 – most prominent spinal process at base of neck
   T-1 – articulate 1st rib and top of lungs
   T-4 – level so tracheal bifurcation
   T-8 – inferior angle of scapulae
   T-9 – top of right dome of diaphragm and bottom of right lung
   T-10 – top of left dome of diaphragm and bottom of left lung

   **Segments**
   Transverse fissure 4th rib midclavicular
   Oblique fissure at 5th rib midaxillary
   Lung border at 8th rib midaxillary
   Pleural border at 10th rib midaxillary
11. Define the following thoracic configuration abnormalities that may be seen upon inspection of the chest wall and the significance of these findings.

**Barrel Chest**: abnormal increase in AP diameter where the normal 45-degree angle between the spine and the intercostal becomes almost horizontal, associated with emphysema.

**Pectus Carinatum**: Abnormal protrusion of the sternum.

**Pectus Excavatum**: Depression of part or all of the sternum, which will produce a restrictive lung defect.

**Kyphosis**: Abnormal AP convex curvature of the thoracic spine.

**Scoliosis**: Abnormal lateral curvature which can cause respiratory compromise.

**Lordosis**: exaggerated forward curvature of the lumbar and cervical regions of the vertebrae.

12. Describe the characteristics and causes of abnormal breathing patterns.

Common causes of an increase in the work of breathing include:

1. Lung diseases that cause loss of lung volume such as pulmonary fibrosis and atelectasis which cause the patient to take rapid, shallow breaths.
2. Lung diseases that cause intrathoracic airways to narrow such as with asthma or bronchitis and cause the patient to have a long expiratory breath.
3. Respiratory disorders that cause the upper airway to narrow such as with croup or epiglottitis and cause the patient to have a long inspiratory breath.

13. Describe the palpation technique of evaluating the presence of tactile fremitus and the causes of increased or decreased fremitus (local and diffuse).

Palpation is used to evaluate vocal fremitis (vibrations created by the vocal cords during speech), estimate thoracic expansion, and assess the skin and subcutaneous tissues of the chest. To assess for tactile fremitus, ask the patient to repeat the word "ninety nine" while you palpate the thorax. Increased fremitus is caused by any condition that increases the density of the lung as with consolidation that occurs in pneumonia. Fremitus is reduced or absent in patients who are obese, or overly muscular. Also, when the pleural space lining the lung becomes filled with air (pneumothorax) or fluid (Pleural effusion). Lastly, people with emphysema have bilateral reduction in fremitus due to reduction of the density of lung tissue.

14. Describe the palpation technique for assessing thoracic expansion.

This palpation technique can be done either by placing hand anteriorly on the chest with the thumbs extended along the costal margin toward the xiphoid process or posteriorly by positioning your hands over the posterolateral chest with the thumbs meeting at the T8 vertebrae. Instruct patient to exhale a maximum breath while you extend your thumbs to meet at the midline. Next, instruct the patient to take a full, deep breath and note the distance the tip of each thumb moves from the midline. Each thumb should move an equal distance of 3-4 cm.

15. Describe the abnormal finding of crepitus and state its significance upon palpation of the subcutaneous tissues.
Crepitus is when air leaks from the lung into the subcutaneous tissue causing fine bubbles to produce a crackling sound and sensation when palpated. This condition is called subcutaneous emphysema.

16. Describe the technique of percussion and identify the sounds produced when the underlying tissues are air-filled, fluid filled, or solid.

Percussion is the art of tapping on a surface to evaluate the underlying structure. Percussion of the chest wall produces a sound and a palpable vibration useful in evaluating underlying lung tissue.

The technique most often used in percussing the chest wall is called mediate, or indirect percussion. If you are right handed, place the middle finger of your left hand firmly against the chest wall parallel to the ribs, with the palm and other fingers held off the chest. Use the tip of the middle finger on your right hand or the lateral aspect of your right thumb to strike the finger against the chest near the base of the terminal phalanx with a quick, sharp blow. Movement of the hand striking the chest should be generated at the wrist, not at the elbow or shoulder.

Percussion over normal lung is described as normal resonance. If you percuss over an increased density the sound is said to be dull as with a fluid filled pleural space. Overinflated lungs have an increased (hyperinflation) resonance.

Percussion over muscle, fat or bone is characterized as flat.

17. Identify the various pulmonary and extrapulmonary abnormalities that are associated with the three basic types of percussion notes.

Normal resonance signifies normal lung.

Increased resonance can be detected with hyperinflated lungs as with pneumothorax, emphysema or severe asthma.

Decreased resonance is due to increased lung tissue density such as pneumonia, atelectasis, tumor or pleural effusion.

18. Identify the four parts of the stethoscope and describe the situations in which it is best to listen with the diaphragm and when it is best to listen with the bell.

The stethoscope has 1. a bell 2. a diaphragm 3. tubing and 4. earpieces. It is best to listen with the diaphragm to the lungs because they have a higher frequency. The bell detects low-pitched heart sounds best.

19. Describe the optimal technique to prepare a patient for auscultation (to include positioning and verbal instructions to the patient).

When possible, the patient should be sitting upright in a relaxed position. Instruct the patient to breathe a little more deeply than normal through an open mouth. Inhalation should be active, with exhalation passive. Place the diaphragm of the stethoscope on the skin underneath the clothing.
20. Describe or demonstrate the proper sequential placement of the stethoscope upon the patient's chest during auscultation.

Auscultation of the lungs must be systematic, including all lobes on the anterior, lateral and posterior chest. Begin with the bases and compare side-to-side and work to the apexes. It is important to begin at the bases because several deep breaths may alter certain abnormal sounds that occur only in the lower lobes. Evaluate at least one full ventilatory cycle at each stethoscope position. See Egan’s fig 14-6 on page 311.

21. List and describe the four characteristic one should listen to when listening to breath sounds.

The key features of breath sounds are:
1. Pitch or Quality (high or low)
2. Amplitude or Intensity (loudness)
3. Duration (inspiratory or expiratory)(beginning, middle, end)

22. Describe bronchial and vesicular breath sounds and state where these sounds are normally heard over the chest.

Vesicular breath sounds are the “slight rustling of air” and are considered normal. The exact mechanism is not known but is believed to be produced mostly during inspiration by turbulent flow in the upper airway. They are heard mostly on inspiration and over all areas of the chest distal to the central airways.

Bronchial (very similar to tracheal) breath sounds are harsher and higher pitch with approximately equal inspiratory and expiratory components. The sound is heard over a major bronchus during normal breathing.

23. Define the term "adventitious".

Normal breath sounds have been traditionally divided into four types: Vesicular, tracheal, bronchial and bronchovesicular.

Adventitious breath sounds are the NOT normal sounds heard in the lungs. They are continuous and discontinuous and are called wheezes, rhonchi, crackles etc. They are abnormal sounds superimposed on the normal lung sounds.

24. Define the following types of breath sounds and describe the quality, intensity, and when in the respiratory cycle these sounds are heard.

a. Rhonchi – low pitched, continuous
b. Wheeze – high pitched, continuous, proximal airways, often expiratory
c. Crackle or rale – discontinuous, distal airways (bases), often inspiratory
e. Friction rub – lower pitch, longer duration then crackles, both I and E
f. Stridor – Heard in the throat area, usually inspiratory if mild

25. Describe the airway or parenchymal abnormalities that are believed to be responsible for each of the sounds of objective #24.
Rhonchi are thought to result from airway narrowing that initially causes rapid airflow past the site of obstruction. The added pressure causes the airway to collapse and briefly touch. When airway pressure increases the airway returns to a more open position, permitting airflow to return. The cycle repeats itself rapidly, causing vibration of the airway walls. The airway obstruction can be relieved with coughing. The rapid flows and tighter obstruction result in higher-pitched sounds. Lower flows and less obstruction will result in lower-pitched sounds. Crackles are probably produced by the bubbling of air through the airway secretions or by the sudden opening of the small airway. These fine crackles are often primarily inspiratory. Wheezes are caused by restriction caused by bronchospasm usually in the larger airways. Friction rubs occur when the normally smooth, moist layers of the pleura develop fibrin deposits or an inflammation that results in added friction. The sound has been compared to the creaking sound of old leather.

26. State the conditions in which a patient may have diminished or absent breath sounds.

When vesicular breath sounds are found to be of less intensity than expected, they are described as diminished (reduced) or even absent in extreme cases. This is caused by a lack of sound transmission through the normal-air-filled lung. Any increase in density of the lung tissue will deaden the normal sound transmission resulting in a diminished sound.

27. Describe the pitch and intensity of stridor and the point in the respiratory cycle in which stridor is heard.

Stridor is caused by the partial obstruction of the upper airways (trachea, larynx). It is often a high-pitched continuous sound heard mostly on inspiration.

28. List the airway abnormalities associated with stridor.

Most often stridor is an inspiratory sound that is loud and can be heard at a distance from the patient. It indicates that a partial laryngeal or tracheal obstruction is present. Epiglottitis, viral croup, foreign body aspiration, airway inflammation following extubation, tumors and tracheal stenosis can cause stridor. Stridor can be a sign of a potentially serious and life-threatening problem, especially in adultren.
29. Describe the adventitious sounds associated with the following conditions:
   a. Atelectasis – Decreased
   b. Pneumonia – Bronchial or absent, possible inspiratory crackles
   c. Emphysema – Diminished
   d. Pneumothorax – Absent
   e. Asthma – Absent, expiratory wheezes
   f. Pleural effusion – Decreased
   g. Pulmonary edema – Diminished, inspiratory crackles
   h. Pulmonary fibrosis – Harsh, inspiratory crackles

30. Describe the auscultation techniques of bronchophony, egophony, and whispered pectoriloquy and state what would be abnormal findings and the conditions associated with each.

Part of a physical assessment may include assessment of vocal sounds. Vibrations created by the vocal cords during speech travel down the airways and to through the peripheral lung units to the chest wall.

1. **Bronchophony** is an increase in intensity and clarity of vocal resonance produced by the enhanced transmission of vocal vibrations caused by increased lung density such as with pneumonia. Hyperinflation of lungs or with pneumothorax results in decrease in vocal vibrations. Easier to determine if only on one side.

2. Normal **Egophony** is the sound of normal voice tones as heard through the chest wall during auscultation. The voice sound increases in intensity and takes on a nasal or a ‘bleating’ quality. An E sounds like an E. Abnormal egophony is when an E changes to an A with consolidation of lung above a pleural effusion or with a pneumonia.

3. **Whispered pectoriloquy**: Whispering is a high pitched sound that normally filters out by lung tissue so whispers sound faint and non-distinct. When consolidation is present, the whispering is transmitted to the chest wall with more clarity. This sign, called whispered pectoriloquy, helps identify areas of lung consolidation. The patient is asked to whisper ‘1-2-3’ or ‘99’ and the doctor listens with his stethoscope. Modern technology such as CAT scans, chest X-rays have caused a shift away from this rather simple technique.

31. List the pathophysiological conditions in which bronchial breath sounds are heard in areas of the chest where normally vesicular breath sounds are heard.

Bronchial breath sounds heard in the peripheral lung regions where you normally hear vesicular breath sounds are caused by increased density of lung tissue as in consolidation, pneumonia and atelectasis.

32. Define "point of maximal impulse", state where it is normally located, and identify the conditions that may shift the PMI.

The point of maximal impulse refers to heart sounds. It is the mid-clavicular line at the 5th
intercostal space. This point may move in an emergency situation of a tension pneumothorax. The lung has collapsed and is pushing the trachea off mid-line and all the internal thoracic organs away from the collapsed lung field. The tension ‘pneumo’ on the right will shift everything to the left side.

33. Describe clubbing and list the pathophysiological processes that are implicated upon its presentation.

Clubbing is the painless enlargement of the terminal phalanges of the fingers and toes that develop over time. The angle of the fingernail to the nail base increases and the base of the nail feels spongy. Many causes of clubbing exist, including infiltrative or interstitial lung disease, bronchiectasis, cancer and heart problems that cause cyanosis. COPD alone, even with hypoxemia do NOT lead to clubbing.

34. Describe cyanosis and differentiate between acrocyanosis (akro – extremity) and central cyanosis.

Cyanosis becomes visible when the amount of unsaturated hemoglobin in the capillary blood exceeds 5 to 6 g/dL. It is easily seen as a bluish tinge. Acrocyanosis (peripheral cyanosis) is the result of poor peripheral circulation and easily seen in the fingernails and skin. The bluish tinge in newborns is normal within the first hour or birth. Central cyanosis is a sign of hypoxemia. It is not seen only measured and is a serious condition that should be corrected with oxygen therapy.

35. Describe why cyanosis is not a reliable method of assessing the severity of tissue hypoxia.

Since we can only easily see peripheral cyanosis and unable to see the actual tissues being perfused, bedside assessing without blood tests is not reliable. Patients with decreased hemoglobin levels (anemia) may not exhibit cyanosis even if tissue hypoxia is present.

36. Describe how to physically assess pedal edema, pitting edema, and other signs of right heart failure.

Pedal edema and pitting edema are caused by excess fluid built up in the lower extremities usually caused by fluid overload and right-sided heart failure. Gravity worsens the pooling of leaking fluid form the vessels into the surrounding tissues. Hospital workers assess capillary refill by pressing briefly but firmly on the patient’s fingernail and noting the speed at which the blood flow returns. When cardiac output is reduced, and digital perfusion is poor, capillary refill is slow. Normal is less than 3 seconds. Poor capillary refill can last over 5 seconds.

37. Describe the techniques used to evaluate peripheral circulation.
One way to assess peripheral circulation is to feel the skin temperature of the hands and feet. If the body has vasoconstrictor trying to compensate and shunt blood to the vital organs, the periphery is cool to the touch. Adequacy of peripheral circulation is assessed by height of the pedal edema is observed up the lower extremity? If the pitting edema is above the knee it signifies a more significant problem then around the ankles.

VOCABULARY
Active Listening uses verbal and non-verbal feedback techniques to indicate an interest and comprehension
Adventitious lung sounds are breath sounds that are different than normal. For example wheezing, rhonchi, crackles and pleural rubs
Apnea is the absence of breathing for a specific period of time (usually at least 10 sec)
Auscultation is the assessment of a patient while listening with the aid of a stethoscope.
Barrel Chest an increased anterior-posterior diameter typical of hyperinflation with COPD.
Biot’s respirations are an irregular depth of breathing with periods of apnea
Bradycardia is slower than normal heart rate i.e. less than 60 BPM
Bradypnea is the less than normal respiratory rate.
Bronchophony is the normal or abnormal voice sounds transmitted from the vocal cords down the broncho-tracheal tree to the chest wall. Used in diagnosing certain conditions.
Capillary refill the length of time need to refill the pinched nail bed. Normal is less than 3 seconds.
Cheyne-Stokes respirations – is a deep, rapid breathing pattern followed by periods of apnea
Cough used to clear airways of secretions. Can be described as barking, brassy or hoarse: effective or inadequate: productive or dry: acute or chronic (>3 weeks); precipitated by exertion, eating or allergies.
Crackles are a discontinuous sound usually in the bases typical with fibrosis or pulmonary edema. Sounds much like rolling your hair with you finger and thumb just above your ear.
Cyanosis is the bluish skin, mucous membrane or nail bed color when the amount of unsaturated hemoglobin in the capillary blood drops by 5 g/dL. It is caused by lack of oxygenation. Peripheral cyanosis ( fingertips and nailbeds) is less advanced or life threatening then central ( blue lips and mucous membranes) cyanosis.
Diaphoresis is sweating usually through fever or exertion.
Diastolic – Systolic pressure the upper and lower number of blood pressure measurement. Normal is 120 / 80 mmHg
Digital Clubbing is a deformity of the nail beds and indicates a longstanding pulmonary disease.
Dyspnea means difficult and labored breathing as perceived by the patient
Eupnea is a normal breathing pattern of 10 to 20 BPM
Febrile is when a patient has a temperature. Normal is 37C (98.6F)
Flail chest is a condition caused by trauma to the chest. The ribs are broken in two different places and are detached from the rest of the normal rib cage.
Fremitus is vibrations transmitted through the skin. There is both vocal and tactile
fremitus.

**Hemoptysis** is coughing up of blood from the respiratory tract. It can be just blood-tinged sputum or full blown large amounts of fresh blood. Caused by tuberculosis, infections, bronchiectasis and others. The origin of the blood also can come from the G.I tract. The origin of the blood must be determined.

**Hypo – hypertension** is low or high blood pressure: normal is 120 / 80

**Inspection** the act of assessing a patient by observation

**Kassmaul’s respirations** are increased depth and rate of breathing seen in metabolic disorders as diabetic ketoacidosis

**Kyphosis – Lordosis – Scoliosis** are unusual configurations of the chest - abdomen posture.

**Orthopnea** is a shortness of breath caused by the position of the patient. For example some patients have difficulty breathing when lying down.

**Palpation** is the assessment of a patient using a hand-touching technique

**Pectus Carinatum – Excavatum** an unusual configuration of the sternum and manubrium

**Percussion** is an assessment technique using indirect tapping on the patient’s chest.

**Phlegm** is another term for sputum

**Pleural Effusion** is the collection of a fluid between the parietal and visceral pleura. If it is excessive it decreases the size of the affected lung and needs to be aspirated with a needle.

**Pleural Friction Rub** is the unusual friction between the pleura. Usually caused by an irritation or inflammation of the lining.

**Pulsus alternans** is an abnormal heart beat pattern when there is an alteration between strong and weak heartbeats.

**Pulsus paradoxus** is an abnormal decrease in pulse pressure with each inspiratory effort

**Purulent** consisting or containing pus

**Rales** an older term for fine crackles

**Rhinocles** are the term used to describe discontinuous sound in the larger upper airways that indicates sputum. Can be cleared with cough.

**Scoliosis** is an abnormal sideways curvature of the spine.

**SOAP charting** is an often used method of dealing with a patients in the hospital and of writing progress notes on a patient in the chart. They represent Subjective, Objective, Assessment and Plan.

**Sputum** is secretion in the airway coughed up by the patient.

**Stridor** is a high-pitched sound coming from the upper airway (throat) caused by a narrowed glottis.

**Subcutaneous emphysema** is a leaking of air from the lungs into the surrounding tissue. It feels like snapping of plastic packing bubbles. Also called crepitus.

**Syncope** is a short period of unconsciousness; passing out; dizzy spell and fainting.

**Tachycardia** is an increased heart rate usually > 120 BPM

**Tachypnea** is a faster than normal respiratory rate but with normal depth of breathing

**Wheeze** are a continuous musical sound originating usually in the bronchi caused by narrowing due to broncho-constriction. Often heard in asthma.
**Whispered Pectoriloquy** is voice sounds of spoken letters or words heard by the therapist via auscultation of the chest. It is a technique used by doctors to identify areas of lung consolidation. The patient is asked to whisper ‘1-2-3’ or ‘99’ and the doctor listens with his stethoscope. When consolidation is present, the whispering is transmitted to the chest wall with more clarity.
**Interventions to Promote Respiratory Function**

Many therapeutic techniques exist to maintain and improve pulmonary function. Several of these techniques are detailed below. The choice of intervention will be made through collaboration among the nurse, respiratory therapist, and physician. No matter which interventions are chosen, the nurse will be responsible for evaluating and documenting the patient’s response during and after treatment.

**Therapeutic Interventions**

**Pursed-lip breathing**

Pursed-lip breathing is used to facilitate complete exhalation in patients with obstructive pulmonary diseases like COPD or emphysema. This technique can be used to reduce air-trapping and dyspnea during periods of stress.

Teach the patient to assume a position of comfort before beginning. Instruct the patient to inhale and pause, then exhale slowly through pursed lips, as if blowing. Pursed-lip breathing is a slow, controlled technique and will be ineffective if performed rapidly. Document the patient’s understanding and ability to perform the technique.

**Deep breathing and coughing**

Deep breathing and coughing are used to facilitate re-expansion of collapsed alveoli following surgery or injury. It is an essential component of pulmonary toilet for any patient at risk for atelectasis and subsequent pneumonia. Deep breathing and coughing exercises are most effective when timed to follow peak effectiveness of pain medications. Patients with thoracic or abdominal incisions will be able to cough more strongly and with less pain if they hold a pillow or towel snugly against their incision before they begin the cough.

To teach deep breathing and coughing, instruct the patient to assume a position of comfort. An upright position will enhance full expansion of the lung bases. Instruct the patient to take several deep breaths, holding each one to a slow count of five at peak inspiration. If a spontaneous cough has not occurred following these breaths, instruct the patient to cough deeply from the diaphragm. Teach the patient that it is not always necessary to clear sputum with coughing; pulmonary benefit is achieved whether the cough is productive or not. Document the quantity, color, odor, and character of any sputum produced and the strength of the patient’s cough effort.

**Incentive Spirometry**

Incentive spirometry is used as an adjunct to deep breathing and coughing. Use of the incentive spirometer gives patients and clinicians visual feedback on the volume of air inspired and the quality of the patient’s technique.

Proper use of the incentive spirometer begins with the patient assuming a position of comfort. An upright posture will facilitate complete lung expansion. Instruct the patient to form a seal around the mouthpiece with the lips and to inhale slowly through the mouth. If the patient has difficulty isolating inhalation to the mouth, a nose clip may be used.
The goal of incentive spirometry is for the patient to achieve a volume of approximately 10 ml/kg if there is no underlying pulmonary disease. This volume target may need to be decreased for patients with pulmonary dysfunction. A properly drawn breath will be slow and steady; most incentive spirometers have an indicator to gauge proper speed. Instruct the patient to rest briefly between every third breath to avoid fatigue and hyperventilation. Generally, incentive spirometry should be performed with a frequency of ten breaths every two hours while awake. Hourly incentive spirometry exercises may be indicated for postoperative patients, those with diagnosed significant atelectasis, or deterioration of pulmonary evaluation findings. Each time incentive spirometry is performed, document the volume achieved by the patient, the number of repetitions performed, and the patient’s tolerance of the procedure.

**Peak Expiratory Flow Monitoring**

Peak expiratory flow (PEF) monitoring is a technique used to provide objective data on airway obstruction for patients with asthma. Baseline expiratory flow readings are taken during periods of optimal symptom management to define a “personal best” PEF. The personal best readings are then compared against those taken during exacerbations of disease to establish relative severity and the effectiveness of therapeutic interventions.

To perform a PEF measurement, the patient should be instructed to use her own PEF monitor. Readings taken on different devices cannot be accurately compared. Three measurements are taken and the best of the three is recorded. Accuracy of a PEF measurement is dependent on technique. If the patient is unable to inhale fully and exhale forcefully into the device, the result will be inaccurate. Due to this diminished reliability, PEF measurements are not generally used during severe exacerbations of pulmonary disease.

**Abdominal/Diaphragmatic Breathing**

Abdominal and diaphragmatic breathing is utilized for patients with chronic and acute obstructive ventilatory disorders, as well as patients with spinal cord injury. It is a combination of deep breathing and pursed-lip exhalation with the use of a pillow to facilitate full exhalation.

To instruct the patient in this technique, first have him assume a position of comfort. An upright position will facilitate lung expansion. The patient holds a pillow over the abdomen and is instructed to inhale slowly, pushing the diaphragm down. When performed correctly, the breath will result in the relaxed abdominal muscles bulging outward; the patient should feel a displacement of the pillow. The patient should pause after inhalation, then exhale using the pursed lip technique previously described while hugging the pillow firmly against the abdomen.

**Postural Drainage, Percussion, and Vibration**

Postural drainage, percussion, and vibration are techniques used to aid in clearance of pulmonary secretions when patients cannot clear them independently. These techniques are most commonly used for chronic management of cystic fibrosis, bronchiectasis, and severe atelectasis. Percussion and vibration are contraindicated in the presence of hemoptysis, bleeding disorders, rib fractures or a predisposition to pathologic fractures, and in patients who do not tolerate the head-down position. Some patients respond to this technique with increased dyspnea and wheezing; in this event, the treatment should be stopped, and the physician notified.
To perform postural drainage, the patient will be positioned to facilitate drainage from the target area of lung. An exhaustive discussion of all positions is beyond the scope of this packet. Refer to your hospital’s policies or one of the references at the end of this packet for further information. Once the desired position is achieved, it is held for five minutes, and the patient is instructed to cough. If clearance of secretions is not achieved, percussion and vibration may be added. Percussion and vibration should be done only over the ribs. Avoid the sternum, vertebral processes, and tissues below the ribs to prevent patient injury. To perform percussion, the hands are held in a cupped position and clapped quickly and firmly against the patient’s ribs over the area to be drained for a period of one to three minutes. Vibration follows percussion using the flattened hands in the same manner over the same area for a period of two to three breaths. Document the positions used, length of treatment, patient’s tolerance of treatment, and the character and quantity of any sputum produced.

High-Frequency Chest Oscillation
This technique replaces postural drainage with percussion and vibration in appropriate patients. High-frequency chest oscillation utilizes a special vest attached to a mechanical device that produces high-frequency vibration of the chest wall.

To use the device, place the patient in a sitting position and apply the vest. Cycle through all the ordered frequencies. To aid in clearing secretions, ask the patient to cough after each change in frequency. The entire treatment requires about fifteen minutes to complete.

If you suffer from a respiratory disease that includes excessive secretion production as one of its symptoms, then the Quake may be able to provide you some important relief. The Quake offers comprehensive and convenient secretion clearance therapy in a portable, easy-to-use, handheld device.

The Quake® utilizes a unique approach to airway clearance. The device is designed to allow you to be in complete control of your therapy. By rotating the Quake’s soft touch handle at various rates, you can create a truly unique and personalized therapy for the removal of secretions from your airways. Rotate the Quake’s handle slowly, the number of oscillations you feel in your lungs decreases but the level of pressure increases. Rotate the handle more quickly, and the oscillations become more frequent while the pressure decreases. This truly allows you to find the type of therapy that suits your needs rather than those of the device itself.

The Quake® is also very easy to clean and can be used in virtually any position: sitting, standing, reclining or any other where you can comfortably rotate the handle.
**Orotracheal and Nasotracheal Suctioning**

Suctioning is indicated for signs of respiratory distress with noisy wet breathing, rhonchi, and ineffective cough effort. Suctioning is contraindicated if the patient has bronchospasm or croup associated with wheezing.

To perform suctioning, familiarize yourself with your hospital’s policies and procedures. Suctioning produces intense discomfort and anxiety for the patient. Explain that being suctioned “takes your breath away” momentarily. Reassure the patient that you will be monitoring their oxygenation status closely during the procedure and explain the precautions taken to assure their safety. Document the teaching provided.

Although policies may vary, the following are some general principles for suctioning. Place the patient in semi-Fowler’s position. Prepare a sterile field for your equipment, and maintain sterile technique during the procedure. If the patient is uncooperative, it may be helpful to have a second clinician in the room during suctioning. Select an appropriate catheter. Hyperoxygenate the patient before suctioning by applying supplemental oxygen and ask the patient to take several slow, deep breaths. Keep the oxygen mask or cannula in place throughout the procedure. Don sterile gloves. Lubricate the catheter liberally with sterile water-soluble lubricant jelly, and advance it to the trachea via either the mouth or nose. DO NOT apply suction during insertion of the catheter. Ask the patient to cough when the tip of the catheter reaches the epiglottic area to facilitate passage of the catheter into the trachea. Pass the catheter into the trachea, but avoid passing the catheter until resistance is felt, as this causes injury to the trachea. Apply suction for 5-10 second intervals while simultaneously rotating and withdrawing the catheter. Monitor oxygen saturation and heart rate during each pass and maintain SpO₂ > 90% or at baseline. Document the characteristics of any sputum obtained and the patient’s tolerance of the procedure.
A complete discussion of all methods of oxygen administration is beyond the scope of this packet. In general, oxygen is non-invasively administered using either low-flow or high-flow delivery systems. Low-flow systems include nasal cannulas, simple face masks, partial rebreathing masks, and non-rebreathing masks. High-flow systems are capable of more precise control of the percentage of oxygen delivered to the patient. They include Venturi and aerosol face masks. For either high or low flow systems to be effective, the patient must be capable of moving sufficient volume in and out of the lungs with each breath. If the patient cannot do this, mechanical ventilation is required.

**Oxygen can cause respiratory depression in patients with chronically elevated blood levels of carbon dioxide. This depression of the hypoxic drive to breathe can result in respiratory failure. Administration of oxygen to these patients must be undertaken with extreme care.**

Oxygen toxicity is a very real threat to patients receiving greater than 50% oxygen for periods longer than 24 hours. Oxygen toxicity can cause cellular damage to the lung tissue that leads to pulmonary fibrosis. Other negative effects of oxygen include:

- Accidental fires and burns
- Dryness of the mucous membranes
- Blindness (in premature infants)
- Atelectasis

**Oral Care**

Oral care is a key component of nursing care. It is a primary intervention for patient comfort and the removal of dental plaque. Dental plaque is a reservoir for pathogens in the oropharynx. The most common bacteria colonized related to respiratory infections are methicillin-resistant Staphylococcus and Pseudomonas species. The toothbrush is the most effective way to remove plaque. All patients require frequent routine toothbrushing to reduce oropharyngeal pathogens and stimulate the gums.

Oral hygiene products, other than the toothbrush, are not effective at removing plaque and may cause complications. Hydrogen peroxide solutions remove debris but concentrated solutions can cause superficial burns. Lemon and glycerin swabs are acidic and cause irritation and decalcification of the teeth. Foam swabs stimulate the mucosal tissues, but do not remove plaque.
Nutrition

Adequate nutrition is essential for patients with pulmonary compromise. Mechanisms of malnutrition include insufficient intake, improper absorption and distribution, or accelerated consumption of nutrients. Patients with pulmonary disease also may have difficulty eating due to shortness of breath and activity intolerance.

Protein-calorie malnutrition is commonly found in hospitalized patients. Insufficient protein intake results in muscle wasting and respiratory muscle weakness. Excessive intake of carbohydrates produces an excess of carbon dioxide that increases demands on the respiratory system.

Nutritional evaluation is based on four categories: anthropometric measurements (body mass index), laboratory data, physical exam, and diet and health history.

**Body mass index** evaluates weight in relation to height. It is measured by dividing the weight in pounds by the height in inches squared. It can also be measured by dividing the weight in kilograms by the height in meters squared.

*The general guidelines for BMI are as follows:*

- BMI<18.5 = underweight
- BMI range 18.5 – 24.9 = desirable
- BMI range 25 – 29.9 = overweight
- BMI > 30 = obese

The use of the BMI as a nutritional indicator can cause problems. Overweight and obese patients require just as much nutrition during periods of illness as patients with normal body weight. **Therefore, do not withhold nutrition based on a high BMI.**

**Laboratory values** used to evaluate nutrition include serum albumin or prealbumin, serum creatine, complete blood count, triglycerides, calcium, phosphorus, magnesium, and urine –24-hr BUN.

<table>
<thead>
<tr>
<th>Anemia: Normocytic (MCV, MCHC)</th>
<th>Common with protein deficiency</th>
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<tbody>
<tr>
<td>Anemia: Microcytic (? MCV, MCH, MCHC)</td>
<td>Indicative of iron deficiency or blood loss</td>
</tr>
<tr>
<td>Anemia: Macrocytic (? MCV)</td>
<td>Common in folate and vitamin B12 deficiency</td>
</tr>
<tr>
<td>Lymphocytopenia</td>
<td>Common in protein deficiency</td>
</tr>
</tbody>
</table>

**Inadequate intake** can be caused by alcohol abuse, anorexia, prolonged nausea, vomiting, confusion, coma, poor dentition, and poverty.

**Inadequate digestion or absorption** can be caused by previous GI surgeries, medications such as antacids, H2 receptor antagonists, cholestyramine, and anticonvulsants.

**Increased nutrient loss** can be caused by blood loss, severe diarrhea, fistulas, draining abscesses, wounds, decubitus ulcers, peritoneal dialysis or hemodialysis, and corticosteroid therapy.

**Increased nutrient requirements** can be caused by fever, surgery, trauma, burns, infection, some types of cancer, and physiologic demands, such as pregnancy, lactation, or growth.

\[
\text{weight BMI } = \frac{\text{height} \times \text{height}}{180^2}
\]
What is chest physiotherapy?

Chest physiotherapy (CPT) is a way to help get mucus out of the lungs. The lobes of the lungs, both back and front, are shown below.

There are two parts to CPT—bronchial drainage and percussion. Do CPT only after you have been taught by a Respiratory Therapist.

**Bronchial drainage** (BD) is positioning the body to allow gravity to help in moving the mucus. Different positions are used so that the area to be drained is highest. Using trendelenberg means positioning the head and chest lower than the hips.

**Percussion or clapping** is tapping the chest wall rhythmically to loosen mucus and move it into the bronchial tubes (large airways) of the lungs.

How do I prepare my child?

The air pocket created between the hand and the chest makes a popping sound. Although this procedure is noisy, if your hands are cupped properly it will not hurt your child.

- Explain what your child will hear and feel.
- Explain what you are going to do using language your child will understand.
- Show your child on a doll what you are going to do.
- Reassure and praise your child throughout the procedure and when you are done.
How should I do CPT?

The doctor will decide what positions your child will need for CPT, and how often to do the therapy. Schedule it before or at least 1 hour after eating.

1. To make percussion more comfortable, your child should wear a thin layer of clothing such as a shirt, or you may use a blanket or towel over the skin. Do not percuss on bare skin.

2. Place your child on a padded surface, using blankets or pillows for positioning and support. Use the checked positions.

3. Percuss each area rhythmically and vigorously.
   - For small children, use a CPT cup.
   - For older children use cupped hands.

4. Percuss _______ minutes in each position as directed.

5. Percuss only over the ribs. Avoid percussing over the spine, breastbone, stomach, lower ribs, and lower back to prevent injury to body organs.

What else do I need to know?

Percussion is less tiring if you keep your arms relaxed and do the movement with your wrists.

If your child has trouble with a position (poor color, hard time breathing, fighting it), sit him or her up until breathing returns to normal, and try again. If you have tried a position 3 times and your child still has trouble, go on to the next position. If you cannot give the full therapy again at the next session, call the doctor.

Various mechanical devices may be used for percussion. If your child needs CPT often, you may want to consult your doctor or therapist for advice.

When should I call the doctor?

- fever
- coughing up fresh blood
- hard time breathing
- lip or nail color becomes blue or gray
- you are unable to give a complete therapy session twice in a row

Questions?

This sheet is not specific to your child, but provides general information. If you have any questions, please call the doctor.

For more reading material about this and other health topics, please call or visit the Family Resource Center library, or visit our Web site: www.childrensmn.org.
Use the positions checked below:

**Note:** your therapist may teach you to adjust some of these positions to meet your child’s needs.

1. **Right and left upper lobes – apical segments**

   Child is sitting up with back supported.

   **Percuss here**

   Percuss just below the collarbones.

2. **Right and left upper lobes – anterior segments**

   Child lies on the back with a pillow under the knees.
   Percuss between the collarbone and nipple on both sides.

   **Percuss here**

3. **Right upper lobe – posterior segment**

   Child lies on left side with a pillow under the left armpit.
   Have child lean forward at a 45° angle against the pillow.
   Percuss on the top part of the right shoulder blade.

   **Percuss here**
4. **Right and left lower lobes – superior segments**

   Child lies with pillows under abdomen (belly) and legs. Percuss on the bottom of, and just below, the shoulder blades.

   Percuss here

5. **Left upper lobe – posterior segment**

   Child lies on right side with a pillow under the right armpit. Have child lean forward at a 45° angle against the pillow. Percuss on the top part of the left shoulder blade.

   Percuss here

**Note:** For positions 6 through 9, the head and chest should be lower than the hips.

6. **Right and left lower lobes – anterior segments**

   Child lies on the back with a pillow under the knees. Percuss both sides just below the nipple and above the lower ribs.

   Percuss here
7. **Right lower lobe – lateral segment**
   
   Child lies on the left side with a pillow under the left lower ribs and hip. 
   Percuss below the right armpit and above the lower ribs.

8. **Right and left lower lobes – basal segments**
   
   Child lies with pillows under abdomen (belly) and legs. 
   Percuss below the shoulder blades and above the lower ribs.

9. **Left lower lobe – lateral segment**
   
   Child lies on the right side with a pillow under the right lower ribs and hip. 
   Percuss below the left armpit and above the lower ribs.
Module 6: Respiratory assessment

Introduction
Oxygen is required for normal body functioning from the cellular level up. The inability to breathe properly and maintain adequate oxygenation is debilitating and decreases quality of life. It results in fear, anxiety and depression, as sufferers are unable to participate in day-to-day life. Assessment of the respiratory system assists clinicians to identify current disease, and, more importantly, to identify risk factors so that intervention can occur before disease develops or progresses.

Preparation

Equipment
- Stethoscope
- Watch with a second hand
- Pen torch
- Tongue depressor
- Gloves
- Pulse oximeter (optional)

Environment
- Quiet surroundings
- Good lighting
- Bed at appropriate height
- Remove clutter

Person
- Privacy and comfort
- Explanation of what you will be doing
- Explain that they will need to expose their chest to you
- Gain Consent
- Upright or semi-fowler’s position

Clinician
- Anatomy and physiology, anatomical landmarks
- Normal ranges for findings
- Sequencing of assessment, head to toe, leaving chest examination until last
- Documentation
- Wash hands
Module 6: Respiratory Assessment

Anatomy and Physiology

Nose
The nose consists of bone and cartilage and is lined with mucous membranes. Receptors from the first cranial nerve (olfactory) are located in the upper part of the nasal cavity and septum. The septum divides the nasal cavity in two.

Purpose:
- Filters air through hairs trapping large particles and prevents them from entering the lower airway
- The rich blood supply of the nose warms and humidifies inspired air

Turbinates
Turbinates (superior, medial and inferior) are located in each side of the nasal wall and increase surface area to assist with warming and filtering of air as it passes to the lungs.

Paranasal Sinuses
The sinuses are air-filled cavities that are connected to the nasal passages and are lined with the same ciliated mucous membrane. The purpose of the sinuses is not fully understood, but they provide mucous to the air passages, lighten the skull and help with phonation by providing resonance. The frontal sinuses are either side of midline above the eye orbits. The maxillary sinuses are in the cheek bones and ethmoid and sphenoid are deeper in the skull near the eye orbits and sphenoid bone.

Pharynx (Throat)
The pharynx is the part of the throat that begins from behind the nose to the beginning of the voice box and the oesophagus. The upper part is called the nasopharynx; below this is the oropharynx and then the laryngopharynx.

Purpose:
- Serves as a muscular passage for food and air. Lymphatic tissue, such as the tonsils, are also located in these areas and serve as an immune defence. Tonsils may atrophy with age.

Larynx
The larynx is part of the airway and is known as the voice box. It is generally more prominent in men than women. It lies midline in the neck.

Purpose:
- Voice production
- Protection of airway from foreign bodies
- Expulsion of contaminants from the lungs

Trachea and Bronchi
The trachea is a tube (comprising of cartilage and ligaments) that connects the nose and mouth to the lungs. The trachea begins at the lower part of the larynx and continues to the lungs. At the sternal angle (anatomical landmark) it branches into the right and left main bronchi.

Purpose:
- Transportation of inspired and expired air

Bronchi
Air is transported along these structures but no gas exchange occurs here. The bronchi are lined with ciliated mucous membranes that secrete mucus. The cilia sweep the mucus and particles up and out of the airways. The right main bronchus is shorter and more vertical, making aspirated objects more likely to enter the right lung.

Bronchioles
The bronchi continually bifurcate into smaller air passages called bronchioles. Bronchioles terminate at the alveolar ducts. Bronchioles are smaller than one millimetre in diameter and they conduct the passage of air to and from the alveoli.

Alveoli
Alveoli are the air sacs of the lungs. They have thin walls and are surrounded by blood capillaries. Gas exchange occurs in the alveoli. The thin wall of the alveoli enables air exchange with the equally thin-walled capillaries of the circulatory system. Blood is bought to the capillaries via the pulmonary artery and taken away by the pulmonary veins.
Module 6: Respiratory assessment

Lungs
- Right Lung has 3 lobes
  - Right Upper Lobe (RUL)
  - Right Middle Lobe (RML)
  - Right Lower Lobe (RLL)
- Left Lung has 2 lobes
  - Left Upper Lobe (LUL)
  - Left Lower Lobe (LLL)

The left lung is larger than the right lung which sits on top of the liver.

Pleura

Pleura are two membranes that form a continuous lining between the lungs and the thoracic wall. The visceral pleura lies along the outside of the lungs and the parietal pleura lines the chest wall and diaphragm. Between the two layers is fluid (surfactant) that creates a negative pressure that serve to keep the lungs inflated and to allow effortless movement with respiration. The space between the two linings is a potential space and any break in the continuous lining will alter the negative pressure; the space will become actual as it fills with air or fluid, such as blood, and can result in lung collapse.

Diaphragm

The diaphragm is a large muscle at the base of the thorax that separates the chest contents from the abdominal contents. It is instrumental in the process of breathing. On inspiration it flattens and increases lung volume, thereby decreasing pressure inside the lung, below that of the pressure outside the lung. As air moves along a pressure gradient from a high to a low pressure the decrease in pressure helps draw air into the lungs. On expiration, as it relaxes, the pressure in the lungs builds to higher than that outside the lungs and air moves out of the lungs as the diaphragm returns to its usual dome shape.

All these soft tissues are protected by the thoracic cage which consists of:
- The Sternum
- 12 pairs of ribs
- 12 thoracic vertebrae
- Muscles
- Cartilage
Module 6: Respiratory assessment

Thoracic landmarks

Anterior Chest

- Clavicles are curved long bones that form part of the shoulder complex. The medial ends join to the manubriums of the sternum and form the sternoclavicular joint and the lateral end joins with the acromion of the scapula.

  The apex or top of the lungs sits about 3–4 cm above the inner third of the clavicles:
  - The first ribs lie just under the clavicles and the suprasternal notch lies between the two clavicles.

- The sternum is mid-line of the anterior thoracic cage and consists of 3 parts – the manubrium, the body and the xiphoid process:
  - Top of the manubrium is the suprasternal notch.
  - A few centimetres below this is a bony ridge called sternal angle or Angle of Louis. This is the join between the manubrium and the body of the sternum.
  - It is also a useful landmark for the location of the 2nd pair of ribs as a useful reference point for where to start counting ribs and intercostal spaces (spaces between two ribs). Count down the middle of the ribs, as it is easier to feel the intercostal spaces than close to the sternum. An intercostal space is numbered by the rib above it.
  - The Angle of Louis is also the landmark where the trachea bifurcates into the right and left bronchi and also the upper border of the aorta of the heart.

- The Costal Margin is the bottom of the rib cage, with the left and right costal margins meeting at the Xyphoid process. The angle formed is usually 90° and is called the costal angle. Variations in the degrees of the angle can indicate conditions such as Chronic Obstructive Pulmonary Disease (COPD) where the angle is greater.

- The diaphragm sits at about the 6th rib and the bottom of the lungs rest on the diaphragm in the mid-clavicular line.

- The anterior chest contains mainly the upper lobes of the right and left lung and middle lobe of the right lung; the lower lobes are mostly found in the posterior chest.

Posterior Chest

- Scapula (shoulder blades) are functional joints of the thoracic cage and lie partially over of the ribs with the 7th or 8th rib being palpable at the inferior border of the scapula.

- Vertebral Prominens is cervical vertebra 7 (C7) and the first rib attaches to Thoracic vertebra 1(T1) just below C7. It is located by flexing the person’s head forward and locating the most prominent bump near the base of the person’s neck. The apex of the lungs is located on either side of C7 and T10 is the level of the base of the lungs.

- Spinous Processes. The bumps you are palpating down the spine are called the spinous processes. From T1 – 4 the ribs attach to and correspond directly with the spinous process; after that the spinous processes cover the rib attachments, so you can’t palpate the rib attachment. This is why you count the spinous processes rather than count the ribs directly.

- 12th rib is a floating rib and the tip can be found midline of T12 and the person’s side.

Purpose of Breathing

- To maintain an adequate oxygen level in the blood to support cellular life.

- Respirations/breathing is caused by various stimuli:
  - Cellular demands
  - Emotional responses
  - Hormonal regulation

The most common stimuli for taking a breath is an increase in carbon dioxide in the blood (hypercapnea) and this is detected by chemoreceptors in the medulla area of the brain and in the carotid and aortic bodies.

Oxygenation Process

Air enters the nostrils and passes through the nasopharynx, the oral pharynx and through the larynx into the trachea. From the trachea it moves into the right and left bronchi that branch into bronchioles, each of which terminates in a cluster of Alveoli where gas exchange takes place.

Blood is pumped from the heart to your lungs via the pulmonary arteries where oxygen from the air you’ve breathed in gets mixed with it. That oxygen-rich blood then travels back to the heart via the pulmonary veins where it is pumped through arteries, arterioles and capillaries to the whole body, delivering oxygen to all the cells in the body including bones, skin and other organs. Veins then carry the oxygen-depleted blood from the capillaries back to the heart and lungs.
Module 6: Respiratory assessment

Normal age-related changes
Nasal hairs may become coarser and become less effective at filtering. The sense of smell diminishes. In the healthy older adult the changes to the lungs that occur with ageing are not so significant despite a diminished performance capacity, but in the presence of frailty and illness, when the limited capacity is met, the changes can have a significant bearing on mortality.

With age the lungs stiffen and muscles and the chest wall atrophy and become more rigid. These changes result in decreased rib wall expansion and muscle weakness. There is an increase in the size of bronchioles and alveoli, which leads to decreased surface area by up to 20% and therefore decreased gas exchange. The volume of air that can be taken in by the lungs does not change (total volume capacity), but the amount of air that can be forcibly expired (vital capacity) is less, because the amount of air left in the lungs after expiration is more (residual lung volume).

The number of cilia decreases so the risk for infection increases. Decreased sensitivity in the respiratory centre to hypoxia and hypercapnea occurs; therefore the body becomes less efficient at controlling respiration.

The cough reflex may be less effective, by as much as 50%. A general decrease in body fluids results in mucous membranes of the respiratory system being drier and producing mucous that is thicker and stickier and potentially an obstructive material.

Changes to the skeletal system, such as kyphosis, also impact on the capacity of rib cage for expansion.

Subjective data
The purpose of the subjective functional health status assessment is to determine risk factors for, or the presence and extent of respiratory disease and the impact of this upon the person’s ability to be self-caring and carry out his/her ADLs.

Note: the oral cavity could also be reviewed here as poor oral hygiene has been linked to respiratory infection in the elderly in aged care settings. Detail for assessment of the oral cavity is included under Nutrition and the Gastrointestinal system discussion.

Review the person’s activities
The person’s perceptions of their general capabilities

- When performing their ADLs
  - Showering
  - Dressing
  - Walking
  - Lifting
  - Carrying

- Exercise Patterns
  - Frequency and Type
  - Importance to the person

- Leisure Activities
  - Frequency
  - Type
  - Importance to the person
  - Perceived time to undertake

Specific questions related to respiratory problems

- Fatigue
  - When did it start and has it changed recently?
  - Recent fatigue and weakness that lasts longer than a day when associated with a persistent cough may be a symptom of pneumonia in the elderly.
  - Do you have enough energy to participate in activities?
  - Is the fatigue more obvious at a particular time of the day? For example, a psychological fatigue is more likely to be present all day, whereas fatigue related to hypoxia or decreased cardiac output is more likely in the evening.
  - Do you experience daytime somnolence (sleepiness)? This may occur because of sleep disturbances related to dyspnoea.

- Physical Weakness
  - Where is the weakness?
  - How does it affect you?

- Severity
  - Ask the person to rate the severity of the presenting symptom in terms of the impact it has on their ability to be self-caring and carry out activities.
Module 6: Respiratory assessment

Dyspnoea (difficulty breathing; shortness of breath)
- When did you first experience shortness of breath? For example, asthma may have started in childhood, but COPD usually doesn’t occur until at least the 40s.
- What type of activity causes it? For example, is it related to exertion or does it occur at rest?
- How much activity can you do before you become short of breath? For example, how many blocks can you walk before you become short of breath?
- Is it harder to inhale or exhale? Dyspnoea related to emphysema may be evident on inhalation as the residual volume of air retained in the lung space increases and the amount of inspired air decreases with each breath.
- Has it changed in the last six months?
- How long does it last for? For example, is it paroxysmal (sudden onset) or constant? Paroxysmal nocturnal dyspnoea is a sign of heart failure and a person experiences shortness of breath at night after they have been lying flat for a while.
- What makes it worse/better? For example, changing positions from lying (recumbent) to upright. With orthopnea (difficulty breathing when lying flat) a person needs to sleep in a more upright position or even in a sitting position supported by pillows. Do you change the way you breathe, such as through pursed lips?
- What effect does it have on your ADLs?
- What are the characteristics; for example, is it associated with a noise, such as wheezing or a change in facial skin colour?
- Do you take any medication to manage it?

Cough
- When does the cough occur? For example, if it is continuous it may be due to an infection; first thing in the morning may indicate a smoker’s cough; a persistent cough may indicate chronic obstructive pulmonary disease (COPD) whereas a cough is intermittent with asthma. A persistent cough is one of the early signs of pneumonia in the elderly.
- Duration: how long have you had it for? Bronchitis is defined by a productive cough for a number of months a year for two consecutive years.
- Describe: For example, is the cough productive (wet) as with pneumonia, dry, or hacking? COPD is associated with a productive cough, whereas an asthmatic cough is non-productive unless there is also infection.
- If the cough is productive you would ask the person to describe what is produced, such as mucous:
  - The colour; for example, is the sputum white and frothy (heart failure/pulmonary oedema), clear or yellow/green (chest infection)?
  - Blood-stained (haemoptysis) (may be tinged with pulmonary oedema or frank blood with a neoplasm or tuberculosis)?
  - Does it have an odour (with infection and purulence)?
  - The amount, for example a teaspoon.
- What makes the cough better or worse? For example, a moist environment or a cold environment; changing body positions from lying to sitting.
- Do you take any medications to relieve it?
- Is the coughing associated with any other symptoms, such as pain or fatigue?
- Confusion may be present with hypoxia; for example, with pneumonia.

Contributing Factors

Personal Risk Factors
- Smoking – a long history of smoking combined with other symptoms may be suggestive of COPD.
  - What do/did you smoke? For example, pipe, cigarettes or cigars?
  - Number per day
  - When did you first start smoking?
  - Have you ever tried to give up? For how long?
  - Have you lived or worked with smokers?
- Personal or previous work environment conditions
  - Exposure to dust, chemicals or pollution
  - What was the source?
  - What was the extent of exposure?
  - Do you think it has affected your breathing?
- Imunisation status
  - Tuberculosis, influenza
Module 6: Respiratory assessment

Medical History (past and recent)
- Allergies – a history of allergies may suggest asthma as the respiratory problem.
  - Triggers for the allergic reaction
  - How does the allergic response manifest?
- Respiratory infections
  - Frequency
  - Type
  - Treatment
- Chronic Respiratory Conditions
  - Asthma, emphysema, bronchitis
  - How long was the episode?
  - How was it treated?
  - Were there any complications?

Family history of respiratory problems
- Allergies, tuberculosis, asthma or lung cancer

Objective data

Assessment Techniques
- Inspection
- Palpation
- Percussion
- Auscultation

Inspection

General Assessment
- Note general appearance
  - Alertness
  - Lethargy
- Observe respiratory effort in relation to activity as well as on rest

Respiratory Rate Assessment:
  - Observe the depth of respiration
    - ribs expand about 2.5 to 5 cm
  - Rhythm is regular
  - Rate (normal ranges at rest):
    - 1 respiration = 1 inspiration and expiration
      - adult – 12–20/Min
    - Take the respiratory rate for 1 minute
    - Observe the rhythm
    - Observe the quality

Normal Findings:
- Alert
- No signs of tiredness or lethargy
- Skin overall pinkish tones
- Good personal hygiene, no body odour
- Appropriately dressed
- Respirations should be quiet, even, regular and effortless with movement of the shoulders (i.e. no use of accessory muscles) seen

Alterations in Breathing Pattern
- Bradypnoea – rate less than 12
- Tachypnoea – greater than 20
- Apnoea – cessation of respiration
- Hyperventilation – rate and depth increase
- Hypoventilation – rate is low and depth is decreased

Detailed Respiratory Assessment

Nose/Nares
- Size
- Shape
- Symmetry
- Discharge

Patency – to test patency press against one nostril to close it off and ask the person to sniff. If they are able to do that then the nare is patent. Do the same for the other side. If patency is missing you can use a pen torch to observe for any sign of obstruction due to inflammation or secretions

Flaring – only occurs when a person is having trouble breathing.

Normal findings
- Nasal structure smooth and symmetrical
- Nares: Patent
- Internal nose mucosa is dark pink and moist free of ulcerations or perforations
- No discharge
Module 6: Respiratory assessment

Sinus
- Observe for any swelling over sinus locations and puffiness of eyes
- Phonation may sound different – the person may sound “blocked up” when they speak
- Palpate over sinus area for tenderness. There should be no tenderness.

Technique
- Using your thumbs press up gently under the eyebrows beside the nose and move along, avoid pressing on the eyes
- Then, using the same technique, press up under the zygomas (cheek bones)
- Ask the person to report any tenderness
- Observation of the oropharynx may detect a post-nasal drip from the sinuses.

Normal findings are the absence of any of the above.

Diagram 2: The Paranasal Sinuses

Mouth and Lips
Cranial nerves can also be tested while examining the face, mouth and tongue (these will be covered in the discussion on the cognitive perceptual system).

- Technique for examining lips and mouth
- Use gloves, tongue blade and torch.

Begin with the external structures and move posteriorly

Lips and Mouth
- Size
- Shape
- Symmetry
- Any lesions or dryness or cracking
- Colour

Technique
- Using the tongue blade, retract the lips and observe the inner surface
- Generally inspect the hygiene of the mouth and condition of the teeth
- Hold the cheek open with the tongue blade and check the colour of the buccal membranes
- Using the pen torch, inspect the throat and oropharynx
- Ask the person to open their mouth and say “aaah”
- Observe the colour of the oropharynx and the presence of tonsils
- If you want a clearer view you can use the tongue blade to depress the tongue. Place the end about half way down the tongue and a bit off centre so that you don’t stimulate the gag reflex
- Note any redness and/or oedema of the oropharynx, and petechiae, or small red spots, on the soft palate caused by Strep throat. (See picture in presentation slides)
- Tracts of white that are not easily scraped off may indicate thrush.

Normal Findings
- Lips smooth and symmetrical
- Pink in light-skinned clients
- Bluish or freckled lips in dark-skinned clients
- Mucous membranes moist with pinkish tones. Xerostomia (dry mouth) is a common condition in the elderly due to some medications (such as anticholinergics), and some systemic diseases such as rheumatoid arthritis
- Tongue pink, moist, central and nil ulcerations
- Oropharynx is the same colour as the rest of the buccal membranes
- Tonsils present or not present
- Throat pink without exudate or lesions
- Clear of obstructions.

Trachea
- Location – should be mid-line (in the middle of the neck)
- You stand behind the person and palpate the location as mid-line.
Module 6:
Respiratory assessment

Normal Findings
- Trachea is mid-line.

Nails
- Colour
- Shape – a 160° angle between nail base and skin. This can be determined by viewing the nail from the side (in profile). (See picture in presentation slides)
- On palpation, the nail base is firm and the nail is firmly adhered to the nail bed.

Normal findings
- Pinkish tones should be seen; no cyanosis of nail beds
- The surface of the nails is smooth and regular with no splitting
- Dark skinned clients may have freckles or pigmentation streaks in their nails
- The nail surface is normally slightly curved or flat and nail edges are smooth, rounded and clean
- No clubbing present (refer to cardiac discussion for diagram and full explanation of clubbing)
- Clubbing often occurs when there is advanced chronic pulmonary disease.

Examination of the Thorax and Lungs
Use landmarks to guide mental visualisation of organs and placement of stethoscope.

Inspection
Preparation: The person should wear a gown, but leave it undone at the back
Perform all assessment techniques on the one aspect (front or back) of the chest before moving around to the other side

Anterior and Posterior Chest
- Skin
- Posture
- Chest wall characteristics
- Depth of respirations
- Respiratory effort

Normal Findings
- Skin tones should be even
- Client should be sitting in upright position arms by sides and relaxed
- Size should be in relation to rest of body, but does differ from race to race
- Chest is symmetrical
- Sternum in mid-line position and straight
- Older people may have a more prominent rib cage due to loss of subcutaneous fat
- Spinous processes should be in a straight line. Ageing usually does result in some kyphosis with an outward curvature of the thoracic spine, this may affect thoracic expansion
- The anteroposterior diameter should be less than the transverse diameter. Basically, what this is saying is that when viewing the side width of the thoracic cage it should be roughly half the size as it appears when looking at the anterior chest wall. The ratio is 1:2. Ratios that vary from this may indicate underlying pathology. For example, with a barrel chest as found with emphysema the ratio is equal
- Ribs sloping downwards, about 45° relative to the spine
- Scapulae are symmetrical. Non-protruding
- Shoulders are at equal horizontal positions
- No use of accessory muscles seen when breathing. Accessory muscles are any muscles that are used to assist respiration when breathing becomes difficult. They could be neck or shoulder muscles. Use of accessory muscles to breathe is NOT normal and can be described as laboured breathing.

Abnormal chest shapes
- Barrel chest may be present in the presence of chronic obstructive pulmonary disease and occurs as a result of chronic over-inflation of the lungs
- Pectus excavatum—or Funnel chest—can be found with asthma and occurs as a result of chronic rib retraction associated with chronically laboured inspiration.

Palpation – Posterior chest
Assess Chest expansion

Technique
- Place your splayed hands at the level of T9 or T10 and slide your hands medially (toward the spine) to pinch up a small piece of skin between your thumbs. Ask the person to take a deep breath and as they do your thumbs should move apart evenly and come back to the starting position on expiration. (See picture in presentation slides)
Module 6: Respiratory assessment

- Unequal chest expansion can be an indication of consolidation or lung collapse, such as with pneumonia or atelectasis.

Assess tactile fremitus

- Tactile fremitus are the vibrations felt when sounds are transmitted through the airways to the lung walls. The important thing is that you compare both sides and the vibration should feel the same at each spot.

Technique

- Use the palmar (palm side) surface of the fingers and palpate the person’s chest while they recite “ninety-nine”. Start over the apex of the lungs and work your way down to the base of the lungs comparing each side in the same spot before you move to the next. Don’t do it over the scapula. In general the further down the chest you move the less the vibration because there is more tissue to dampen the vibration
- Abnormal fremitus occurs with anything that obstructs vibration, such as with a pleural effusion. Increased fremitus occurs with consolidation or pneumonia. You would expect to feel the decrease or increase only on the affected side
- Palpate the chest wall and spine, and intercostal spaces for tenderness, alignment and surface masses
- Use fingers to palpate and back of hand for temperature
- Compare bilaterally
- Be systematic in your approach.

Normal Findings

- Palpation of chest should find no tenderness or pain
- Rib connections to sternum should be flat
- Temperature should be equal bilaterally
- Chest expansion should be equal.

Percussion

Review the technique described in the general assessment discussion.

Some suggest that you should only percuss if abnormal sounds are heard on auscultation.

The main thing is to be systematic and compare each side in roughly the same spot. The sounds will change depending on whether you percuss over air or a solid structure. Dullness may indicate an area of consolidation, such as with pneumonia.

Auscultation

Technique: Posterior chest

- Have the person sitting up, leaning forward slightly with arms in their lap
- Ask the person to breathe through their mouth a bit deeper than usual, but be aware of hyperventilation that may result in dizziness or fainting
- Use the diaphragm (flat end) of the stethoscope and press it directly against the skin
- Listen at each spot for a full breath and compare side to side as you move over the lung fields (from C7 – about T10)
- Bronchial sounds may be heard in abnormal places when there is consolidation
- Also listen over the lateral lung fields from the axilla down
- Voice sounds can also be listened to in the same way as breath sounds:
  - Ask the client to repeat 99 while listening to the chest
  - The sounds should be soft and muffled; the sound of the voice should be heard, but not what is being said
  - Ask the client to repeat the letter “E”
  - The sounds should be soft and muffled and the “E” should be distinguishable.
Module 6: Respiratory assessment

Activity
Find a willing partner and auscultate the normal breath sounds heard over the lung fields.
Compare what you hear with the characteristics listed in the table above.

Anterior chest auscultation
The technique is the same for the posterior approach, but you also listen for bronchial sounds over the trachea.

Normal Findings
- Normal findings would be the specific sounds heard in the designated areas
- Some sounds may be hard to hear on people who are obese or heavily muscled as this increases the distance from the lung fields
- No adventitious sounds should be heard. If you do hear abnormal sounds then get the client to cough and listen again as they sometimes are present when secretions settle after a person has been lying for a time, but clear quickly when the person moves or coughs.

Auscultation Assessment
Abnormal Breath Sounds or Adventitious Breath Sounds
Are sounds you would not expect to hear over the lung fields? The noise is superimposed on the normal lung sounds and by secretions or inflation of collapsed airways. Common examples are crackles (rales) and wheezes (rhonchi).
- Crackles are non-musical, brief sounds heard mainly on inspiration. They are caused as air bubbles through secretions or temporarily inflates incompletely closed airways on expiration
- They are classified as
  - Fine (soft high pitched very brief)
  - Coarse (low pitch, louder and less brief)
- Wheezes are continuous high- or low-pitched musical sounds and are created as air is pushed and vibrates through narrowed airways, such as is heard with acute asthma. They are normally heard on expiration but sometimes on inspiration.
- Causes
  - Asthma
  - CHF
  - Chronic Bronchitis
  - COPD
  - Pulmonary Oedema
- Stridor is an inspiratory musical wheeze heard loudest over the trachea during inspiration. It can be a complication after an anaesthetic or assisted ventilation.
  Stridor suggests an obstruction of the trachea or larynx and constitutes a medical emergency and requires immediate medical attention.

Table 1: Normal Breath Sounds

<table>
<thead>
<tr>
<th>Breath Sound</th>
<th>Location</th>
<th>Characteristic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchial</td>
<td>Over the trachea</td>
<td>Loud, high pitched and hollow sounding</td>
<td>Shorter on inspiration and longer on expiration</td>
</tr>
<tr>
<td>Broncho-vesicular</td>
<td>Over main stem bronchi</td>
<td>Medium pitched but soft and breezy</td>
<td>Equal Inspiration/expiration</td>
</tr>
<tr>
<td>Vesicular</td>
<td>Over most of lung fields</td>
<td>Low pitched sounds – soft and breezy</td>
<td>Longer at inspiration and shorter on expiration</td>
</tr>
</tbody>
</table>
Module 6: Respiratory assessment

- Pleural Rub is creaking or brushing sounds produced when pleural surfaces are inflamed and rub against each other. They may be continuous or discontinuous and can be localised to a particular place on the chest wall. They may be heard during inspiration and expiration. They may be associated with complaints of pain, particularly on inspiration.

- Causes
  - Pleural Effusion
  - Pneumothorax

Assessment of abnormal sounds should include:
- Loudness
- Pitch
- Duration
- Number
- Timing in the respiratory pattern
- Location; and do they change after coughing or change of position?

Knowing this information aids in diagnosing the underlying pathology. For example, a late inspiratory, coarse crackle can be a sign of pneumonia.

**Pulse Oximetry**

- Assesses the level of oxygen in the blood available to tissues
  - Oxygen saturation (SaO2) reflects the percentage of haemoglobin (Hb) that is bound with oxygen (SaO2 of 98% indicates that 98% of the Hb molecules are carrying oxygen molecules)
  - Normally SaO2 is over 96%. It may be lower in the older person, but not by much. Establish a person’s baseline by checking the reading again on a different finger
  - A pulse oximeter measures pulse saturation (SPO2), which is a reliable estimate of arterial saturation (SaO2)

- It can be monitored continuously or intermittently
- It only measures oxygen content not oxygen metabolism. The probe detects colour changes in arterial blood and calculates saturation from this
- The pulse oximeter emits two wave lengths of light—one red and one infra red—which pass from a light emitting diode (on one side of probe) to a photoreceptor (on the opposite side)
- Well-oxygenated blood absorbs light differently than de-oxygenated blood
- The oximeter determines the amount of light absorbed by the vascular bed and uses this to calculate the oxygen saturation SaO2
- Pulse oximetry does not provide information regarding:
  - Ventilation status
  - pH
  - pCO2 (still require arterial blood gases (ABG))
- It is less accurate than ABGs, but less invasive and quickly indicates a problem.

Anything below 96% would warrant investigation. If a person has oxygen therapy going you would want to test the level with and without oxygen.

**Technique**

A probe that emits two beams of light is attached to
- Ear
- Finger
- Toe
- Forehead
- Bridge of nose

You need to be able to detect a strong pulse in the area, so make sure the peripheries are warm and nail polish is removed so the light can get through.

Turn the machine on and wait for a reading.

The following can cause inaccurate readings:
- Motion
- Low perfusion
- Anaemia
- Fluoro lights
- Intravascular dyes (e.g. those used in radiology)
- Acrylic nails
- Dark skin colour.
Module 6: Respiratory assessment

Focused assessment

Respiratory-related chest pain

The predominant respiratory derived chest pain is pleuritic and the main feature is sharp pain on inspiration. It is found with many conditions, such as pneumonia, pulmonary emboli, pleural effusions, pneumothorax.

Chest Pain

See cardiac-focused assessment for general assessment of chest pain. Listed below is information related specifically to sources of respiratory chest pain:

- When did it start and how long has it lasted for?
- Where does it hurt?
- What precipitates it? Chest infection, trauma, coughing.
- What relieves it? What have you done to treat it and were the interventions successful?
- Is it associated with other symptoms, such as fever or coughing?
- Are you taking any medications for the chest pain? If so, what are they and do they work?

Example

You enter the room of Mrs J and find her still in bed. Normally she is up and about and has a rest in the afternoon. Her morning cup of tea and breakfast are untouched. She is 84 years old and has a history of COPD associated with smoking and congestive cardiac failure. She tells you that she is exhausted and feeling more short of breath than usual.

You take her vital signs and establish that she has no fever or pain. She tells you that she has a productive cough with grayish-white sputum. Her colour is pale and she is making an obvious effort to breathe using her accessory muscles. Her respiratory rate is 32 bpm. Her pulse is 94 bpm. Her blood pressure is low 98/76 mm/Hg and her oxygen saturation is 91%. You listen to her chest and her breath sounds are dull over the right lower lobe, but hyperresonant at the bronchus. You hear fine crackles particularly over the right lower lobe. There is dullness when you percuss over this area. Her right side has decreased expansion on inspiration. She falls asleep while you document your findings. When you return a little while later to reassess her you find that her responses to your questions are confused.

You discuss your findings with a colleague and you both try to work out what might be going on.

Activity

Using this data:

1. Cluster the data into related groups; for example, data that relates to nutrition.
2. Examine the grouped data and list your hypothesis about actual or potential health problems derived from each grouping.
3. Can you confirm any actual problems or a very high risk for developing a problem? That is, diagnose a problem, because you have enough information to say it exists or the person is very likely to develop it.
4. List your diagnoses.
5. Identify what further data you would need to obtain in order to make any or further diagnoses.

Comment

The older person does not always present with pneumonia the same as a younger person. Ageing affects the immune response and you don’t get the fever associated with an immune reaction or purulent sputum. Pneumonia signs and symptoms are typically vague in older people and confusion and fatigue may be the first indications of pneumonia. Her past history predisposes her to be susceptible to infection.
Module 6: Respiratory assessment

Resources

Websites
- http://bookbing.org/physiology-powerpoint-lectures/
- Sinus diagram
- Diagrams from http://www.gla.ac.uk/ibls/US/fab/tutorial/generic/sapulse.html downloaded on 19/02/2011

Audio grabs for breath sounds
- http://www.cvmbs.colostate.edu/clinsci/callan/breathsounds.htm
- http://www.rale.ca/Recordings.htm

References

Texts

Articles
Respiratory Care Section

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### 1.0 DESCRIPTION

#### 1.1 Definition

Chest physiotherapy (CPT) is one aspect of bronchial hygiene and may include turning, postural drainage, chest percussion and vibration, and specialized cough techniques known as directed cough. Any or all of these techniques may be performed in conjunction with medicinal aerosol therapy (i.e., bronchodilators or mucolytics). The goals of CPT are to move bronchial secretions to the central airways via gravity, external manipulation of the chest, and to eliminate secretions by cough or aspiration with a catheter. Improved mobilization of bronchial secretions contributes to improved ventilation-perfusion matching and the normalization of the functional residual capacity.

**NOTE:** CPT will not be done if IPV is ordered.

1.1.1 Turning is the rotation of the body about its long axis. This is usually done in conjunction with procedures designed to aid patient comfort and skin care. However, attention to chest position and deliberate region-specific positioning is usually needed to effect secretion mobilization. Special beds which periodically impose a programmable position change provide an adjunct to manual turning of the patient.

1.1.2 Postural drainage is the positioning of the patient and bed in such a way as to have the carina inferior to a lung segment to be drained. The targeted lung segment is as nearly perpendicular to the ground as possible. The aim is to move secretions from peripheral to more central airways for elimination. The duration is usually 3 to 15 minutes per segment depending on the properties of the secretions.

1.1.3 Percussion may also be referred to as cupping or clapping. These names describe the manual rhythmic striking of the thorax over a
lung segment which is being drained. The theory is that this energy is transmitted through the chest wall to the lung and is able to dislodge secretions adhering to lung tissue. Mechanical and pneumatic devices which mimic this action are available. This action may also be used to initiate a cough by percussing over the large airways.

1.1.4 Vibration is the placement of hands along the ribs in the direction of expiratory movement of the chest. A small rapid vibration (tremor) and slight pressure is applied during exhalation to accentuate this phase of the respiratory cycle. The maneuver mimics the forced exhalation of a cough. A vigorous form of this manual vibration combined with positive pressure ventilation is called an "artificial cough". This is used as an assist technique for sputum removal in paralyzed patients on ventilators. Mechanical devices used to perform vibration differ from the manual method in that the mechanical device is continuously applied during both inspiration and exhalation.

1.1.5 When the spontaneous cough is inadequate to mobilize secretions, directed cough techniques may be employed. Directed cough techniques are deliberate maneuvers that are taught, supervised, and monitored. The Forced Expiratory Technique, or "huff cough," and manually assisted cough are two such maneuvers. Refer to the AARC Clinical Practice Guideline "Directed Cough" for further instruction regarding these techniques.

1.2 Indications

The following are general indications which suggest the need to evaluate a patient for the appropriateness of CPT. Following these is a list of technique-specific indications.

1.2.1 Excessive sputum production

1.2.2 Reduced effectiveness of cough

1.2.3 History of success in treating a pulmonary problem with CPT

1.2.4 Adventitious breath sounds suggestive of secretions in the airways which persist after coughing

1.2.5 Change in vital signs

1.2.6 Abnormal chest radiograph suggesting atelectasis, mucus plugging, or infiltrates
1.2.7 Significant deterioration in the indices of gas exchange from baseline status

1.2.8 Turning
   1.2.8.1 Inability or reluctance of patient to change body position
   1.2.8.2 Poor oxygenation associated with position, i.e. unilateral lung disease
   1.2.8.3 Potential or actual atelectasis
   1.2.8.4 Presence of an artificial airway

1.2.9 Postural Drainage
   1.2.9.1 Evidence or suggestion of difficulty with secretion clearance
   1.2.9.2 Adult having difficulty expectorating sputum volume greater than approximately 25 ml/day
   1.2.9.3 Evidence or suggestion of retained secretions in a patient with an artificial airway
   1.2.9.4 Presence of atelectasis caused by or suspected of being caused by mucus plugging
   1.2.9.5 Diagnosis of a disease with altered rheology such as cystic fibrosis, bronchiectasis, or cavitary lung disease
   1.2.9.6 Presence of a foreign body in the airway

1.2.10 Percussion/Vibration
   1.2.10.1 Sputum volume or consistency suggesting a need for additional manipulation (percussion and/or vibration) to assist movement of sputum in a patient receiving postural drainage

1.2.11 Directed Cough
   1.2.11.1 Atelectasis
   1.2.11.2 Postoperative prophylaxis against retained secretions for patients with an ineffective spontaneous cough
   1.2.11.3 As a routine part of bronchial hygiene in patients with cystic fibrosis, bronchiectasis, chronic bronchitis, necrotizing pulmonary infection, spinal cord injury, or ineffective spontaneous cough

1.3 Contraindications: The decision to intensify the patient's bronchial hygiene program by initiating CPT requires a careful assessment of the risks versus the benefits of intervention. Therapy must be modified according to the patient's needs, tolerance, condition, and therapeutic goals, and assessment must be ongoing through each subsequent therapy session. Therapy is modified to improve results while minimizing risk, pain and discomfort. Continual assessment and modification of therapy render most
contraindications as relative with the exception of those absolute
contraindication noted below.

1.3.1 Positioning
1.3.1.1 Absolute: Unstabilized head and/or neck injury
1.3.1.2 Absolute: Active hemorrhage with hemodynamic
    instability or significant possibility of occurrence
1.3.1.3 Intracranial pressure (ICP) greater than 20 mm Hg
1.3.1.4 Recent spinal surgery (i.e., laminectomy)
1.3.1.5 Acute spinal injury
1.3.1.6 Active hemoptysis
1.3.1.7 Empyema
1.3.1.8 Bronchopleural fistula
1.3.1.9 Cardiogenic pulmonary edema
1.3.1.10 Large pleural effusion
1.3.1.11 Pulmonary embolism
1.3.1.12 Confused, anxious, or otherwise impaired patients who
    actively resist or do not tolerate position changes
1.3.1.13 Rib fracture with or without flail chest or other significant
    chest injury
1.3.1.14 Surgical wound or healing tissue

1.3.2 Trendelenburg Position
1.3.2.1 ICP greater than 20 mm Hg
1.3.2.2 Conditions in which increases in ICP must be avoided (i.e.,
    neurosurgery, aneurysms, and eye surgery)
1.3.2.3 Uncontrolled hypertension
1.3.2.4 Abdominal distension which compromises patient comfort
    or clinical status
1.3.2.5 Esophageal or other upper body surgery adversely affected
    by this position
1.3.2.6 Lung carcinoma recently treated by surgery or radiation
    with actual or significant potential of hemoptysis
1.3.2.7 Uncontrolled airway with significant risk of aspiration
    (tube feeding or recent meal)

1.3.3 Reverse Trendelenberg Position
1.3.3.1 Hypotension
1.3.3.2 History of orthostatic hypotension
1.3.3.3 Vasoactive drug administration

1.3.4 Percussion and/or Vibration
1.3.4.1 Subcutaneous emphysema
1.3.4.2 Recent epidural anesthesia or recent epidural or intrathecal
    drug administration
1.3.4.3 Recent skin grafts or flaps on the thorax
1.3.4.4 Burns, open wounds, and skin infections of the thorax
1.3.4.5 Recently placed transvenous or subcutaneous pacemaker (mechanical vibration and percussion are relatively more contraindicated)
1.3.4.6 Suspected or known active pulmonary tuberculosis
1.3.4.7 Lung contusion
1.3.4.8 Worsening bronchospasm
1.3.4.9 Osteomyelitis of the thorax
1.3.4.10 Osteoporosis of the thoracolumbar region
1.3.4.11 Coagulopathy or thrombocytopenia (manual vibration may be well tolerated)
1.3.4.12 Complaints of chest wall pain
1.3.4.13 **Absolute**: Osteogenesis imperfecta or other bone disease associated with brittle or extremely fragile bones

1.3.5 Directed Cough
1.3.5.1 **Absolute**: Inability to control possible transmission of infection from patients suspected or known to have pulmonary tuberculosis
1.3.5.2 Elevated intracranial pressure or known intracranial aneurysm
1.3.5.3 Acute unstable head, neck or spine injury
1.3.5.4 Reduced coronary artery perfusion, as in acute myocardial infarction
1.3.5.5 Unconscious patient with unprotected airway
1.3.5.6 Acute abdomen (i.e., abdominal aortic aneurysm, hiatal hernia, or pregnancy)
1.3.5.7 Untreated pneumothorax of flail chest
1.3.5.8 Osteoporosis of the thoracolumbar region
1.3.5.9 Coagulopathy or thrombocytopenia

1.4 Precautions

1.4.1 Application of the various techniques of chest physiotherapy may pose risks to some patients (See 1.5 Adverse Reactions and Interventions). Appropriate precautions include the immediate availability of functional suction equipment, emergency airway equipment, and oxygen therapy equipment which allows for upward adjustment in the delivered FiO₂. Patients should also be monitored throughout therapy for changes in the respiratory pattern, work of breathing, pulse, and skin color.

1.4.2 Adrenergic bronchodilators in solution and metered dose inhalers should be available in case of significant bronchospasm during treatment.
1.4.3 Instruction in proper cough technique prior to therapy may decrease the risk of decompensation in case of pulmonary hemorrhage or mobilization of copious secretions.

1.4.4 Because the optimal positioning of patients in the intensive care unit may be difficult (due to invasive and other apparatus) and treatment times may be compromised due to patient tolerance or the urgency of other care interventions, the effectiveness of CPT may also be compromised.

1.4.5 The absence of an acceptable cough may render application of CPT less effective. Diligence in coaching the patient to an effective cough as well as timely suctioning of the trachea are essential to performing good CPT.

1.5 Adverse Reactions and Interventions

1.5.1 Hypoxemia: Administer higher concentrations of oxygen before and during therapy if the patient has a potential or history of falling arterial oxygen saturation. Increase the oxygen concentration if vigorous, paroxysmal, or violent coughing is precipitated. If increases in oxygen concentrations fail to prevent or correct hypoxemia, administer maximal oxygen (100% if possible), discontinue the therapy, return the patient to an appropriate rest position (usually the one prior to therapy), ensure adequate ventilation, and notify the physician and nurse. Hypoxemia during CPT may be avoided by judicious modification of therapy so that ventilation-perfusion relationships are not worsened. In unilateral lung disease, for example, avoid positioning the affected side down or do so for the absolute minimum time needed to accomplish the therapeutic goal.

1.5.2 Increases in Intracranial Pressure: Patients at risk for neurological status changes (i.e., patients with clotting or bleeding abnormalities) must be closely monitored. Assess the patient frequently for his/her tolerance of the therapy, especially for acute onset or worsening headache. Monitor closely for changes in vital signs and other indicators of neurologic status (i.e., alertness and orientation). If changes occur, discontinue the therapy, return the patient to an appropriate rest position (usually the one prior to therapy), ensure adequate ventilation, and notify the nurse. Consult the physician regarding a reassessment of the risks to the patient versus the benefits of therapy.

1.5.3 Acute hypotension during therapy: An acute fall in the blood pressure must be heated by a return of the patient to an appropriate
rest position (usually the one prior to therapy). Ensure adequate ventilation, consult the physician, and notify the nurse. Be prepared to place the patient in the Trendelenberg position if his/her condition warrants it.

1.5.4 Pulmonary Hemorrhage: In the event that hemoptysis ensues, stop the therapy immediately, return the patient to an appropriate rest position (usually the one prior to the therapy), and assist the patient as needed to maintain a proper airway and adequate ventilation. Notify the physician and nurse of the urgency of the situation and remain with the patient until the physician responds.

1.5.5 Pain or Injury to Muscles, Ribs or Spine: Coordination of CPT with pain medication administration may serve to lessen the pain in patients. Assure the patient that you will not exceed his/her pain threshold. Modify techniques according to the patient's tolerance of the procedure. When discomfort becomes acute and is directly associated with the therapy, stop the treatment. Consult with the physician and nurse regarding a plan to minimize risks to the patient while optimizing achievement of the goals of therapy.

1.5.6 Vomiting and/or Aspiration: The Trendelenberg position is contraindicated in patients clearly at risk of aspiration. Prior to starting therapy, be sure that the patient is not experiencing nausea and has not just eaten. Tube feeding should be discontinued a minimum of 15 minutes prior to beginning a CPT session. In the event of airway compromise, discontinue the therapy, and assist the patient to maintain an open airway via suctioning maneuvers as needed. Place the patient in an upright position, and administer oxygen as indicated. Consult with the physician and nurse regarding a plan to minimize the risks of therapy while optimizing achievement of the goals of therapy.

1.5.7 Bronchospasm: CPT is contraindicated in acute asthma. Significant cough-induced bronchospasm should be attended by a return of the patient to an appropriate rest position (usually the one prior to therapy), oxygen administration as needed, and a consultation with the physician regarding the need to administer bronchodilators.

1.5.8 Dysrhythmias: Dysrhythmias associated with CPT must be judged for clinical severity and cause. A baseline dysrhythmia does not preclude CPT. Attempts to prevent it by modifying therapy should be tried. If a significant dysrhythmia develops, administer maximal oxygen (100% if possible), stop the therapy, return the patient to an appropriate rest position (Usually the one prior to
therapy), and notify the physician and nurse immediately. If dysrhythmia is life-threatening, activate the emergency response team and begin CPR. Do not leave the patient until the situation is stabilized.

1.5.9 Excessive Lung Volume During Mechanical Ventilation: Dramatic increases in lung volumes are a real possibility with CPT. Ventilatory parameters should be monitored throughout therapy to ensure the appropriateness of mechanical ventilator settings. **Patients placed in the pressure control mode are particularly at risk for serious lung injury if sudden removal of secretions leads to dangerously high tidal volumes.** Should the patient's volumes become consistently greater than 12 ml/kg of body weight, return the patient to an appropriate rest position (usually the one prior to therapy), and reevaluate the tidal volume. The persistence of a high tidal volume warrants a decrease in inspiratory pressure to return tidal volumes to less than 12 ml/kg of body weight. Consult with the physician regarding further need for adjustment of the ventilator parameters.

1.6 Assessment of Outcome: The following criteria support the continuation of therapy.

1.6.1 Change in Sputum Production: An adequate level of hydration is necessary to properly assess the volume of sputum and ease of expectoration. For patients who produce less than 25 ml of sputum per day, and who are adequately hydrated, CPT is not indicated. Also, in patients for whom an increase in the amount of expectorated sputum is not realized after the initiation of CPT, therapy should be discontinued.

1.6.2 Change in Breath Sounds: Initially only assisted cough methods should be used to evaluate change if breath sounds greater than that observed with assisted cough alone. Breath sounds should be evaluated over several hours. Movement of sputum to more central airways may be construed as clinical deterioration because adventitious breath sounds may become louder, more numerous, lower-pitched, or otherwise "worse." however, effective expectoration may not occur until well after the end of the CPT session.

1.6.3 Subjective Change Reported by Patient: The clinician should ask the patient how he/she feels before, during, and after therapy. Feelings of pain, dyspnea, syncope, nausea, or other discomfort must be considered in deciding whether to modify or discontinue therapy. Easier clearance of secretions and increased volume of
secretions during or after treatment support continuation of therapy.

1.6.4 Improved Quality of Sleep: Subjective or apparent improvement in the quality of sleep attributable to effective secretion clearance may result from CPT. This supports continuation of therapy.

1.6.5 Change in Vital Signs: Any change in vital signs must be investigated and its cause and severity determined. One common reason for a deterioration in vital signs is patient fatigue. Significant changes in vital signs are an indication to curtail CPT activities. The clinician should anticipate the patient becoming fatigued, and have the patient conserve enough energy to be able to cough effectively or to tolerate suction of the trachea.

1.6.6 Change in the Chest Radiograph: Resolution or improvement of a patient's chest film suggest the need for a reevaluation therapy.

1.6.7 Change in Gas Exchange: Significant improvement of a patient's blood gas status or oxygen saturation suggests the need for a reevaluation of therapy.

1.6.8 Change in Lung Mechanics: Patients who are monitored for lung mechanics or are mechanically ventilated may be evaluated for changes in resistance and/or compliance. Changes consistent with resolution of atelectasis and mucus plugging, i.e. decreased resistance and increased compliance, may necessitate a discontinuation of therapy.

2.0 EQUIPMENT

2.1 A bed capable of Trendelenberg and reverse Trendelenberg positions

2.2 Pillows for position and/or cough support and patient comfort

2.3 Patient gown or light towel to cover percussed area

2.4 Tissues and/or basin for sputum disposal

2.5 Functioning suction equipment including a Yankauer suction catheter

2.6 Optional mechanical assist devices, i.e. mechanical percussor or plastic percussion cups

2.7 Stethoscope
2.8 Cardiopulmonary monitor

2.9 Pulse oximeter

2.10 Emergency airway equipment including manual resuscitator

2.11 Universal precautions attire

2.12 Most recent chest radiograph

3.0 PROCEDURE

3.1 Assess the patient's chest radiograph for pulmonary findings and assess the indications for bronchial hygiene therapy and chest physiotherapy for the patient. Determine which regions of the lung require attention.

3.2 Prior to implementing CPT procedure, assess the patient for respiratory rate and work of breathing, heart rate and rhythm, skin color, blood pressure, pulse oximetry, and breath sounds. Interview the patient if possible as to subjective feelings of cough effectiveness and the ability to mobilize secretions, and breathing difficulty (i.e., the ability to take a deep breath or the existence of exertional dyspnea).

3.3 Perform CPT techniques appropriate for the patient.

3.4 Monitor the following throughout the therapy session and immediately following therapy:
   • the patient's reaction to the therapy including subjective responses to pain
   • discomfort and dyspnea
   • heart rate and rhythm
   • respiratory rate and pattern including work of breathing
   • cough and sputum production including color, quantity, consistency, and odor
   • breath sounds
   • skin color
   • mental status
   • oxygen saturation by pulse oximeter
   • blood pressure
   • use of splinting, external cough supports, or special cough techniques
For specific instruction on special cough techniques, refer to the AARC Clinical Practice Guideline "Directed Cough"

3.5 Modify the techniques of CPT according to patient tolerance, and assist with sputum clearance as needed.
3.6 The frequency of therapy sessions is determined by a good assessment of the patient's clinical status and the indications for therapy as described in 3.1 and 3.2 above, and according to the following guidelines:

3.6.1 Turning: Mechanically ventilated patients should be turned at least once every two hours as tolerated. Confer with the nurse to optimize a turning schedule.

3.6.2 Postural Drainage: During the acute phase of a pulmonary process, perform therapy at least every four hours. Daily reevaluation should be performed and the frequency reduced as soon as the indications for therapy show improvement, see Section 1.2.

3.6.3 Percussion/Vibration: Perform as needed in conjunction with postural drainage. Discontinue when reevaluation reveals that postural drainage alone is sufficient.

3.6.4 Directed Cough: Perform as often as needed to prevent atelectasis and secretion retention, and before and after other CPT procedures.

3.7 Ensure patient comfort and safety prior to leaving the bedside.

4.0 POST PROCEDURE

4.1 Chart the procedure in the "Comments" section of the "Continuous Ventilation Record". Include all pertinent information as described in 3.2 and 3.4 above, and record the lung regions drained/percussed, the response to therapy, and adverse reactions.

4.2 Report all significant findings to the nurse and physician caring for the patient.

4.3 Disinfect all nondisposable equipment used and store appropriately.

5.0 REFERENCES

5.1 AARC Clinical Practice Guideline "Postural Drainage Therapy"

5.2 AARC Clinical Practice Guideline "Directed Cough"
PURPOSE:
To prevent or reverse hypoxemia and provide oxygen to the tissues.

CONSIDERATIONS:
1. Oxygen is provided to the patient through a variety of devices (e.g., mask, nasal cannula, tracheostomy collar) from a variety of sources (e.g., cylinder, concentrator, liquid oxygen system).
2. Home oxygen therapy is provided as a joint effort of the patient and family, physician, respiratory vendor, respiratory therapist, and homecare staff. The nurse must carefully coordinate the activities and teaching strategies of all healthcare providers to prevent overwhelming or confusing the patient and/or family.
3. Oxygen therapy must be prescribed by the patient’s physician, not the respiratory equipment vendor. The physician is responsible for identifying the type of therapy, the rate (LPM), based on Arterial Blood Gases, and equipment needed by the patient. The nurse and/or respiratory therapist may need to provide vital information regarding sources of electricity, financial circumstances, mobility of patient, etc., to enable the physician to make an appropriate selection.
4. Oxygen masks may not be appropriate for use with chronic obstructive pulmonary disease patients because oxygen delivery cannot be controlled with precision.
5. A tracheostomy collar or tracheostomy mask is indicated when oxygen must be given to a patient with a tracheostomy.
6. Trans-tracheal oxygen therapy is held in place by a necklace. Since trans-tracheal oxygen therapy bypasses the mouth, nose and throat, a humidifier is required at flow rates of 1 LPM or greater.
7. Oxygen promotes and feeds combustion. The patient should be cautioned about the following:
   a. Oxygen concentrator will perform best when it’s located in a well-ventilated area at least 3 (three) inches away from walls, furniture, and curtains.
   b. Visitors & family members should smoke outdoors. “No Smoking” Signs are to be posted throughout all areas of the home where oxygen will be in use including the front door.
   c. Avoid all open flames. Person using oxygen should stay a minimum of 5 feet from any open flame.
   d. Oxygen concentrator’s are equipped with an audible alarm to alert you in case of an interruption in power or a possible equipment malfunction.
   e. Do not use any oily substances (petroleum based lip products, Vaseline, Blistex, Chapstick) on your nose, lips, or lower part of your face. An alternative is water-based products such as KY Jelly. Keep all grease, oil and petroleum products (even small amounts) and flammable materials away from your oxygen equipment. These materials can react violently with oxygen if ignited and cause a hot spark.
   f. Smoke Alarms and Fire Extinguishers
      - Have a working smoke detector on each level of your home. Ideally, smoke detectors should be placed in common areas of your home and outside of bedrooms. Many local fire departments have established smoke alarm programs to assist the community in obtaining home smoke alarms.
      - Smoke detectors should be tested on a regular basis and batteries should be changed every six months.
      - Have a working fire extinguisher and know how to use it. A fire extinguisher can be purchased at most home improvement or department stores.
   g. Using Electrical Equipment
      - Do not use equipment with frayed cords or exposed wires. They could cause a spark.
      - Plug concentrator into a properly grounded electrical wall outlet. Do not plug oxygen into an outlet controlled by a light switch.
      - Avoid using electric razors and hair dryers while using oxygen. Battery operated razors and hair dryers if they have less than 10 volts can be used.
      - Do not use extension cords with oxygen equipment. Concentrator may cause the cord to overheat and cause a fire.
      - Do not use an appliance with a control box, such as a heating pad or electric blanket. Control boxes may throw sparks.
8. Oxygen Storage & Handling
   a. Keep oxygen cylinders/concentrators in a well ventilated area (not in closets, behind curtains, or other confined spaces.)
   b. Keep oxygen at least 6 feet from any fireplace, stove or electrical appliance such as hairdryer, electric toothbrush or razor, electric blanket, electric toy, space heater or electric baseboard heater.
   c. Keep the oxygen as far away as possible from an oven or stove while cooking, and be very wary of grease splatters.
   d. Keep the oxygen away from any flammable liquid.
   e. Oxygen cylinders must remain upright at all times. Never tip an oxygen cylinder on its side or try to roll it to a new location.
   f. Do not transport oxygen tanks in the trunk of a car. Oxygen tanks need to be transported properly secured to reduce movement.
   g. Always have a full back-up tank available in case of emergencies, such as a need to leave your home or a power failure. Should tank gauge not read full, patient should notify the oxygen provider of need for a full tank delivery.
   h. Minimum on 2 full tanks should be kept on hand.
   i. Patient is not to use back-up tanks for portability. This increases the risk of not having an adequate supply of oxygen on hand should an emergency occur.

   Oxygen is colorless, odorless and tasteless. Patients who receive inadequate oxygen may not be aware they are suffering from hypoxia. Families and health professionals should observe the patient frequently for symptoms of hypoxia (shortage of oxygen in the body):
   a. Restlessness, anxiety/euphoria.
   b. Irregular respirations/dyspnea.
   c. Drowsiness/confusion and/or inability to concentrate/altered level of consciousness.
   d. Increased heart rate/arrhythmia.
   e. Perspiration, cold, clammy skin.
   f. Flaring of nostrils, use of accessory muscles of respiration.
   g. Altered blood pressure.
   h. Yawning.
   i. Cyanosis.
   j. Muscle and mental fatigue.
   k. Headache.
   l. Dizziness/visual impairment.
   m. Nausea.

9. Patients with compromised respiratory systems are understandably anxious about ongoing oxygen supply.
   a. A back-up source of oxygen should be available in the patient's home in case the oxygen source malfunctions or is prematurely depleted.

10. Give emergency phone numbers to the patient for:
   a. Paramedics and ambulance.
   b. Physician.
   c. Home health agency.
   d. Respiratory equipment vendor.
   e. Hospital.

11. Teach family members to operate, maintain and troubleshoot equipment. Equipment should be checked at least daily.

12. Patients experiencing inadequate oxygenation may feel that more oxygen will relieve their discomfort. Therefore, it is essential to emphasize to the patient that oxygen is to be used only at the flow rate prescribed. Alert the patient to the danger of oxygen above prescribed limits.

13. Water-soluble lubricant may be applied to lips and nasal membranes PRN for dryness and lubrication.

14. Moisture and pressure may cause skin breakdown under oxygen tubing and straps on administration devices. Therefore, the skin must be examined frequently, kept clean and dry, and relieved of pressure. Gauze may be tucked under tubing.

15. Oxygen delivery devices should be cleaned or replaced when dirty or contaminated with secretions to prevent infection.

16. If used, humidifier water should be replaced:
   a. If water is below a minimum level
   b. Daily. Adding water to the water present in the humidifier will encourage growth of bacteria. The humidifier bottle should be cleaned or changed at least every 2 weeks.

17. DO NOT use more than 50 feet of oxygen extension tubing connected to oxygen delivery device.

EQUIPMENT:
Stethoscope
Oxygen source (cylinder, concentrator or liquid oxygen system)
Oxygen delivery device (cannula, mask, trach collar), 2 sets
Humidity bottles and adapters, if needed
Sterile distilled water
"Oxygen in Use" signs
Cleansing solution
Gloves
Instructions for specific types of equipment from vendor supplying equipment*

* A wide variety of oxygen therapy equipment is available from respiratory equipment suppliers. To describe the exact operation of each type is beyond the scope of this procedure. It is imperative that the nurse reviews the operation of specific equipment with the vendor. General guidelines for major types of equipment are included in this procedure.

PROCEDURE:
1. Adhere to Standard Precautions.
2. Explain procedure to patient.
3. Review order from physician for oxygen therapy.
4. Evaluate the patient's respiratory status. Assure a patent airway before commencing oxygen administration.
5. Post "Oxygen in Use" warning sign. Evaluate environment for hazards related to combustion.
6. Evaluate patency of nostrils if nasal cannula is to be used.
7. Prepare oxygen source:
   a. Crack (break seal) on cylinder, plug in concentrator, check liquid contents of liquid system.
   b. Screw humidifier onto tank outlet or concentrator oxygen outlet, if humidifier is to be used.
   c. Connect oxygen tubing to oxygen source.
   d. Set flow on flow dial, flow tube, oxygen flow control, or flow meter at prescribed liter flow.
   e. If concentrator is used, turn power switch on and adjust flow rate.
8. Apply oxygen delivery device:
   a. Nasal Cannula
      (1) Set flow rate as ordered (humidity not required for ≤ 4L/minute)
         (a) 1-2 L/minute provides 23-30% O2
         (b) 3-5 L/minute provides 30-40% O2
         (c) 6 L/minute provides 42% O2
      (2) Place prongs in nostrils with flat surface against skin.
      (3) If prongs are curved, direct curve downward toward floor of nostrils.
      (4) Secure cannula tubing over each ear and slide adjuster under chin to secure tubing taking care to adjust to patient comfort.
      (5) Clean nasal cannula daily and PRN. (Refer to After Care.)
   b. Oxygen Mask
      (1) Select a mask that will afford patient the best fit.
      (2) Set flow rate as ordered by physician. Rate must exceed 5 liters/minute to flush mask of carbon dioxide. In high humidity masks, oxygen should be turned up until mist flows from mask. For low flow systems:
         (a) Simple mask: 6-8 L/minute provides 40-60% oxygen.
         (b) Partial rebreather mask: 6-11 L/minute provides 50-75% oxygen.
         (c) Non-rebreather: 12 L/minute provides 80-100% oxygen.
      (3) Position mask over the patient's face covering the nose, mouth and chin to obtain a tight seal.
   c. Trach Collar or Trach Mask
      (1) Attach the large-bore tubing coming from the oxygen source to the swivel adapter on the collar.
      (2) Set oxygen flow rate and concentration as ordered.
         (a) 8-10 L/minute provides 30-100% oxygen in this high flow system
      (3) Place elastic strap in one flange of trach collar.
      (4) Place collar's opening directly over the patient's tracheostomy tube.
      (5) Slip the unattached end of the elastic strap behind the patient's neck while stabilizing trach collar with free hand. Attach elastic to free flange. Tighten gently.
      (6) Position wide bore tubing.
      (7) DO NOT block exhalation port.
      (8) Assure that nebulizer delivers constant mist.
      (9) Empty any build-up of condensation every 2 hours.
      (10) Clean tracheostomy collar as needed.
9. Discard soiled supplies in appropriate containers.

AFTER CARE:
1. Clean oxygen therapy equipment as instructed by respiratory equipment company using cleaning solution. Two sets should be used alternately with one being cleaned while the other in use. (See Cleaning and Disinfection of Respiratory Therapy Equipment.)
2. Document in patient's record:
   a. Date and time oxygen is being used.
   b. Flow rate and concentration of oxygen.
   c. Patient's response to oxygen therapy.
d. Findings of physical assessment.

e. Equipment evaluation for safety, functioning and time of oxygen source change.

f. Instructions given to patient/caregiver.

g. Patient/caregiver understanding of instructions using ‘teach back’ method.
PURPOSE:
To assess patient’s lung capacity and ability to push air out of the lungs.

CONSIDERATIONS:
1. Using a peak flow meter is important to determine the patient’s lung function.
2. Often times medication is prescribed based on peak flow meter measurements.
3. Measuring lung function is especially important to those with asthma and Chronic Obstructive Pulmonary Disease.
4. Peak flow meter measurements can often times see the onset of a problem before symptoms arise.
5. Peak flow measurements should always be taken around the same time each day.
6. A normal peak flow measurement is based on the race, sex, age and height. A normal reading for a patient can be found by keeping a log of peak flow measurements.
7. When the patient is within 80-100% of their personal best, they are considered to be in the green zone. This means their asthma is under control.
8. When the patient is within in 50-79% of their personal best, this is considered the yellow zone. Patient may need quick relief medications as their asthma is getting worse.
9. When the patient drops below 50% of their personal best, the patient needs to take quick relief medication and seek medical attention immediately.
10. Adults, teenagers and larger children can use a standard peak flow meter. Small children need to use a low range peak flow meter.

EQUIPMENT:
Peak flow meter
Peak flow meter daily log book

PROCEDURE:
1. Have peak flow meter set at the bottom of the scale.
2. Have patient remove any food or gum from his/her mouth.
3. Patient should stand up straight; instruct him/her to take a deep breath in.
4. Creating a complete seal around the mouth piece of the flow meter and keeping the tongue away from the mouthpiece, instruct patient to blow one breath out as fast and hard as possible. The force of the breath will push the marker up the meter giving a measurement of their lung capacity.
5. Document this number.
6. Instruct the patient to perform the measurement 3 more times. The patient has performed the test properly when all the measurements are close together.
7. Once you have documented the measurements, record the highest reading in the patient’s log book and in the patient record. The highest measurement, not the average, shows patient’s lung capacity. Be sure to include the time and date that the measurement was taken.

AFTER CARE:
1. Document measurement in patient’s record.
2. Contact physician as needed.
3. Instruct patient and caregiver to continue using peak flow meter and to document measurements in patient’s daily log book.
4. Instruct patient and caregiver to contact a physician if measurements are below normal for the patient, based on the log book.
5. Instruct the patient to clean the peak flow meter on a regular basis and after each use when the patient is sick.

REFERENCES:
(The Ohio State University Medical Center.) Peak Flow Meter, Retrieved July 23, 2010 from http://medicalcenter.osu.edu/patientcare/healthcare_services/allergy_asthma/about_asthma/asthma_peak_flow_meter/Pages/index.aspx
PURPOSE:
To provide means of draining malignant or persistent pleural effusion.

CONSIDERATIONS:
1. The Pleurx catheter is used primarily for draining persistent or malignant pleural effusion.
2. The catheter is a surgically implanted tunneled tube leading from the pleural space and exiting the body in the area of the upper abdomen.
3. Care of the catheter requires sterile technique and the patient/family should be thoroughly instructed.
4. The insertion site should be assessed for signs/symptoms of infection with each drainage/dressing change.
5. The dressing is changed with each drainage procedure and whenever the occlusive dressing is soiled.
6. The frequency of drainage is determined by the physician's orders. The amount of drainage will change, usually decreasing over time. No more than 1,000 mL (or 2 vacuum canisters) may be drained at any one time. The vacuum canisters are technically 600 mL but only fill to approximately 500 mL.
7. Assess the patient for pain, discomfort or the development of a dry, hacking cough. If the cough occurs, the drainage is to be stopped until the patient is no longer coughing. The procedure may then be reinitiated.
8. Patient may shower when occlusive dressing is intact. Patient may not bathe.
9. Instruct patient to keep scissors and other sharp objects away from catheter.

EQUIPMENT:
Gloves and other personal protective equipment
Pleurx catheter drain/dressing kit
Leak-proof bag

PROCEDURE:
1. Verify physician order for drainage frequency.
2. Adhere to Standard Precautions and hand hygiene.
3. Explain procedure to patient.
4. Prepare materials for procedure.
5. Place leak-proof bag to act as waste receptacle.
6. Open pleurx kit and establish sterile field.
7. Open and place alcohol wipes at field edge.
8. Apply clean gloves and remove old dressing. Place old dressing in waste bag.
9. Clean the cap of the catheter tubing with an alcohol wipe, remove it and discard. The end of the catheter tubing must be protected from soiling once the cap is removed.
10. Remove soiled gloves and perform hand hygiene.
11. Apply sterile gloves and open the pleurx drainage bottle bag. Be sure that all of the clamps on the vacuum bottle are closed and that the green accordion valve on the vacuum bottle is depressed. If the accordion valve is not depressed, there has been a loss of vacuum. DO NOT use the bottle if the accordion valve is not depressed (i.e., in up position).
12. Remove the plastic cover from the tip of the vacuum bottle tubing and open the slide clamp at the base of the vacuum bottle.
13. Pick up the catheter tubing end in your non-dominant hand and the vacuum tubing tip in your dominant hand. Insert the tip into the catheter end and twist to the right until a “click” is heard.
14. Open the pinch clamp and allow the drainage to begin.
15. Assess the patient for pain, shortness of breath or the development of a dry, hacking cough. If any of the above occurs, the drainage may be slowed by closing the pinch clamp and allowing the patient to relax.
16. After the drainage has stopped (no more than 2 vacuum bottles may be used equaling a total of 1,000 mL), close the pinch clamp securely and disconnect the vacuum tubing tip from the catheter end by turning it to the left until a “click” is heard. Discard the vacuum bottle and tubing in the waste receptacle and wipe the catheter end with an alcohol wipe.
17. Place the new cover cap on the catheter end.
18. Assess the catheter insertion site for signs/symptoms of infection. Clean the area with an alcohol pad, cleaning in a circular motion starting from the insertion site and working outward.
19. Place the split foam catheter pad over the insertion site and curl the tubing up over the pad.
20. Cover foam pad and curled tubing with 4x4's and then cover the entire area with the clear occlusive dressing from the kit. Make sure the edges of the occlusive dressing are secure.
21. Place all paper refuse in a waste receptacle, discard gloves and tie off waste bag.
22. Perform hand hygiene.

AFTERCARE:
1. Document in patient’s record:
   a. Time and date of the procedure.
   b. Amount, color and quality of the drainage fluid.
   c. The patient’s tolerance/response to the procedure.
   d. The condition of the insertion site and surrounding skin.
   e. Instructions given to the patient/caregiver.
   f. Communication with physician.
Purpose:
To obtain specimen for the culture of respiratory pathogens by tracheal suctioning via nasopharyngeal route.

Considerations:
1. Sputum is a mucous secretion produced in the lungs and bronchi. There are several methods of obtaining specimens:
   a. Expectoration.
   b. Tracheal suction.
2. Mouth care is given prior to specimen collection to decrease contamination with oral bacteria and food, if specimen is obtained by expectoration. (Literature suggests that specimen should be collected prior to brushing teeth or using mouthwash, only using water to clean mouth.)
3. It is optimal to schedule specimen collection prior to breakfast.
4. Oxygen-dependent patients should receive oxygen before and after tracheal suctioning.
5. Specimen must be transported in appropriately marked leak-proof, unbreakable container.

Equipment:
Impervious trash bag
Sterile specimen container or in-line collection trap
Tissues
Basin
Cup with mouthwash
Suction catheter
Sterile gloves
Flashlight
Tongue blade
Normal saline
Gloves
Mask, goggles
[Note: Tracheal suction kit will include sterile suction catheter and gloves.]

Procedure:
1. Adhere to Standard Precautions.
2. Expectoration:
   a. Explain procedure to patient.
   b. Position patient in high-Fowler's position.
   c. Have patient rinse mouth with water.
   d. Instruct patient to breathe deeply, cough and expectorate into sterile container. Instruct patient to avoid touching the inside of the container.
   e. Cap and label container immediately. Note on label any antibiotic therapy patient is receiving or has recently completed.
   f. Offer tissue to patient to wipe mouth.
3. Tracheal suction:
   a. Explain procedure to patient.
   b. Check suction machine to be sure that it is operating correctly.
   c. Fill basin with normal saline.
   d. Place patient in semi- to high-Fowler's position.
   e. Connect in-line trap collection container to the suction tubing.
   f. Put on gloves. Attach sterile suction catheter to tubing of specimen trap container.
   g. Instruct patient to tilt head back. Lubricate catheter with normal saline and gently pass suction catheter through nostril.
   h. If obstruction felt in nares, attempt other side.
   i. As catheter reaches juncture of larynx, patient will cough. Immediately pass catheter into trachea. At this time, instruct patient to take several deep breaths to ease passage of catheter.
   j. Apply suction for 5 to 10 seconds. Discontinue suction and remove catheter.
   k. Detach catheter from specimen trap. Holding the catheter in gloved hand, remove glove, enclosing the catheter, and dispose in impervious bag.
   l. Disconnect specimen container from suction machine, leaving tubing attached to lid. Seal container by looping tubing to other opening on lid.
   m. Label container. Note on label any antibiotic therapy patient is receiving or has recently completed.
4. Discard soiled supplies in appropriate containers.
5. Transport specimen in an appropriate container.

After Care:
1. Document in patient's record:
   a. Time, date and delivery of specimen to laboratory.
   b. Color, consistency and odor of sputum.
   c. Method of specimen collection.
   d. Patient's response to procedure.
   e. Communication with physician.
Respiratory – Tracheal Suctioning  
SECTION: 9.18

Strength of Evidence Level: 3

Purpose:
To maintain oxygenation by removing the secretions from the trachea to prevent occlusion of the airway.

Considerations:
1. Whenever possible, the patient should be encouraged to clear the airway by directed coughs or other airway clearance techniques. The need for suctioning procedure needs to be established (i.e., coarse breath sounds, noisy breathing, etc.).
2. Tracheal suctioning may be accomplished by means of a suction catheter inserted through the mouth, nose, tracheal stoma, tracheostomy or endotracheal tube.
3. Nasotracheal and oral-tracheal suctioning are clean procedures. Tracheostomy suctioning is generally a clean procedure. If the tracheostomy is new (within 4 to 6 weeks) or the patient is immuno-compromised, sterile technique should be used. If both oral/nasal tracheal suctioning must be done during the procedure, begin with tracheal suctioning then continue with oral/nasal suctioning.
4. Suctioning removes not only secretions but also oxygen. If the patient has oxygen ordered, the patient should be hyperoxygenated with 100% oxygen before and after suctioning. Be sure to return oxygen to previously prescribed liter flow and concentration after procedure is completed.
5. If the patient has a tracheostomy tube, keep extra sterile tracheostomy tubes of the same size and obturator on hand in case of accidental expulsion or blocked tube.
6. If the patient has a cuffed tracheostomy tube, deflation prior to suctioning is not required.
7. Indications that the patient requires suctioning include:
   a. Noisy, moist respirations.
   b. Increased pulse.
   c. Increased respirations.
   d. Non-productive coughing.
   e. More frequent or congested sounding coughs.
   f. Visible secretions.
   g. Increased shortness of breath.
8. Avoid unnecessary suctioning as the tracheal mucosa may become irritated and infection may be introduced.
9. If the patient is receiving nasotracheal suctioning, he/she should be instructed to take deep breaths as the catheter is advanced.
10. Tenacious secretions may be liquified by instilling 3-5 mL of normal saline into the trachea, if ordered by the physician. Humidification of the airway is essential to keeping secretions loose and easily removed. Keeping the patient well hydrated will also assist in maintaining loose secretions. Adequate humidification in the home environment is also important.
11. During performance of this procedure, the patient should be observed for:
   a. Hypoxia.
   b. Bronchospasm.
   c. Cardiac arrhythmias.
   d. Bloody aspirations.
   e. Hypotension.
12. To avoid damage to the airways and hypoxia, suction should be applied intermittently for periods not to exceed 5 to 10 seconds. Suction catheter should not be left in the trachea for longer than 10 seconds. Suction should be set at ≤120 mmHg. Intermittent suction is applied as catheter is withdrawn only. Reoxygenate between attempts. Maximum number of attempts should be 2 suction passes/episode.
13. Suction catheter size should be no more than 1/2 (one-half) the internal diameter of the artificial airway to avoid greater negative pressure in the airway and potentially minimize the PaO2.
14. DO NOT force the suction catheter into the airway beyond resistance.

Equipment:
- Oxygen source, if patient has oxygen ordered
- Suction machine and suction catheter
- Distilled water
- Gloves
- Clean suction catheter with control valve or Y connector (diameter should be no larger than half the diameter of tracheostomy tube)
- Clean solution container
- Impervious trash bag
- Sterile, water-soluble lubricant, if catheter is to be inserted through the nasal passage
- Tissues

Procedure:
1. Verify physician’s order for suctioning.
2. Adhere to Standard Precautions.
3. Explain procedure to patient.
4. Prepare suction machine according to manufacturer’s instruction.
5. Set suction pressure between 100-120 mm Hg.
7. Place patient in semi-Fowler’s position to promote lung expansion.
8. Prepare suction catheter:
   a. Set up clean work field.
   b. Obtain clean suction catheters.
   c. Pour distilled water or sterile saline into clean solution container.
   d. Put on gloves.
   e. Connect suction catheter to suction machine and turn on machine.
9. Place catheter tip in distilled water, occlude catheter port with thumb and suction a small amount of water through the catheter.

10. Encourage patient to take several deep breaths prior to start of suctioning.

11. Suctioning procedure - Mouth, Throat:
   a. Dip catheter tip into sterile normal saline/sterile water to lubricate outside and facilitate insertion.
   b. Insert catheter into mouth and/or back of throat.
   c. Cover suction catheter port with thumb and suction intermittently while rotating catheter.
   d. Perform procedure intermittently until secretions are cleared.

12. Suctioning procedure - Nasal insertion:
   a. Lubricate tip of catheter with sterile, water-soluble lubricant.
   b. Remove oxygen delivery device, if applicable, and insert catheter into the nares during inhalation and gently advance the catheter without applying suction.
   c. Insert catheter about 20 cm in adults, 14-20 cm in older children, 14-20 cm in young children and 8-14 cm in infants.
   d. Cover suction catheter port and suction intermittently while rotating catheter. Apply intermittent suction while withdrawing the catheter.
   e. Perform procedure until secretions are cleared. Allow time between suction passes for ventilation and oxygenation. Avoid tiring patient or precipitating hypoxia.
   f. Rinse the catheter and connection tubing with normal saline or water until cleared. Dispose of the catheter once suctioning is completed.

13. Suctioning procedure - Tracheostomy:
   a. Check tracheostomy tube to make sure it is tied securely.
   b. Dip catheter tip into sterile, normal saline to lubricate outside and facilitate insertion.
   c. Insert catheter into tracheostomy or trach tube.
   d. DO NOT force catheter beyond point of resistance.
   e. Cover suction catheter port intermittently.
   f. Slowly withdraw and rotate catheter to clear secretions. DO NOT exceed 10 seconds.
   g. Before reinserting catheter allow patient to rest and encourage taking 2 or 3 deep breaths. Reoxygenate patient, if needed.
   h. If fenestrated tracheostomy, change inner cannula without hole.

14. Rinse the suction catheter with distilled water between insertions.

15. Monitor patient's respiratory status during procedure. If patient becomes short of breath, agitated, or hypoxic, discontinue suctioning and oxygenate the patient.

16. At conclusion of procedure, instruct patient to take several deep breaths. Hyperoxygenate for several minutes if a patient has oxygen ordered.

17. Return oxygen liter and concentration rate to normal, if patient is on continuous oxygen.

18. Auscultate lungs; assess pulmonary status, skin color, and vital signs. Monitor the patient for adverse reactions.

19. Clear catheter and connecting tubing by aspirating remaining water solution.

20. Turn off suction. Disconnect catheter.

21. Discard soiled supplies in appropriate containers.

AFTER CARE:

1. Disassemble suction catheter and solution container and clean suction lines and reservoir bottle. (See Cleaning and Disinfection of Respiratory Therapy Equipment.)

2. Clean hands per appropriate hand hygiene procedure.

3. Document in patient's record:
   a. Patient's response to procedure.
   b. Amount, viscosity, odor and color of secretions.
   c. Findings of cardiopulmonary assessment before and after treatment.
   d. Oxygenation before, during and after treatment.
   e. Instructions given to patient/caregiver.
   f. Patient/caregiver understanding of instructions using the 'teach back' method.
   g. Communication with physician.
PURPOSE:
To minimize infection and maintain airway.

CONSIDERATIONS:
1. Generally in homecare, tracheostomy care is a clean procedure. If the tracheostomy is new (within 4 to 6 weeks) or patient is immuno-compromised, sterile technique should be used. Sterile technique is also recommended if infection is present (until infection resolved) or if the caretaker has an infection.
2. Tracheostomy tubes should be changed every 3 to 4 weeks in adults and every 1 to 2 weeks in children. Verify physician order to change trach tube.
3. It is recommended that suctioning equipment be kept available for an emergency, especially for patients with new tracheostomy tubes or when the patient’s condition requires suctioning to control secretions.
4. Keep two extra sterile tracheostomy tubes and obturators on hand in case of accidental expulsion of the tube or blocked tube. One tube should be the same size the client currently has and one tube should be one size smaller.
5. Outer cannula can only be changed:
   a. After obtaining physician's order.
   b. After outer cannula has previously been changed without problems at doctor's office, hospital or clinic.
6. Cuff should only be inflated with a minimally occlusive volume to maintain seal. A cuff pressure measuring device may also be used to check the cuff pressure.
7. Many masks/mouthpieces distributed for protection while performing artificial respiration are not adaptable for use with a tracheostomy tube. When a patient has a tracheostomy tube and has not been designated as do not resuscitate, special equipment such as a manual bag-valve-mask resuscitator or a mask/mouthpiece that can be used with a tracheostomy tube should be available to protect the nurse, if artificial ventilation is needed.
8. It is recommended that patient be given nothing by mouth (NPO: Nulla Per Os) or has tube feedings held for at least 1 hour before procedure.

EQUIPMENT:
Gloves and other personal protective equipment, as needed (including face shield)
2 sterile tracheostomy tubes (1 being the size of the one in place and 1 a size smaller)
Obturator
Water-soluble lubricant
Scissors
Normal saline
Distilled water
Mirror
4x4 pre-cut gauze tracheostomy or pre-cut surgical sponge dressing
Twill tape or Velcro tracheostomy tube holder.
Magic slate or pad for messages
4x4 gauze sponge soaked with normal saline
5-10 mL syringe for cuffed tracheostomy tube
Suctioning equipment

PROCEDURE:
1. Adhere to Standard Precautions.
2. Explain procedure to patient and caregiver.
3. Prepare new tracheostomy tube for insertion:
   a. Test - inflate the cuff on cuffed tubes.
   b. Fold one end of twill tape up 1/2 (one-half) inch and make a 1/4-inch slit; prepare two pieces, one larger than the other, in this manner.
   c. Slip slit end through side of outer cannula and pull twill tape through slit. Repeat on other side with second piece of twill tape.
   d. If client has a Velcro tracheostomy tube holder, place narrow ends of ties under and through the faceplate slits. Pull ends even and secure with Velcro holders.
   e. Remove inner cannula.
   f. Insert obturator in outer cannula.
   g. Apply a thin film of water-soluble lubricant to the surface of the outer cannula and the tip of the obturator.
4. Suction patient via tracheostomy tube. If cuffed tube is in place, suction orally.
5. Check to see if patient has cuffed tracheostomy tube in place. If he/she does, deflate by attaching a 5-10 mL syringe into the cuff balloon and slowly withdrawing all air from the cuff. Note amount of air withdrawn.
6. Prepare to remove the old tube (allow patient to use mirror if he/she is learning to perform this procedure). Use scissors to cut the twill ties on the old tube. If patient has Velcro tracheostomy tube holder, undo the tabs attached to the Velcro fastener.
7. Remove the old tube by the neck flange using an outward and downward motion. Removal of the tube may trigger a coughing spasm. If coughing produces secretions, cleanse stoma with gauze soaked with normal saline before inserting new tube.
8. Tell patient to take a deep breath and insert new outer cannula with obturator while pushing back and then down. The tube will slide into place as gentle, inward pressure is applied.
9. Once the cannula is properly inserted, immediately remove the obturator and hold tube in place until the patient's urge to cough subsides.
10. Ensure that there is air exchange through the tube.
11. Instruct the patient to flex his/her neck and bring twill ties around to the side of the neck to tie them together in a square knot. Closure on the side will allow easy access and prevent necrosis at the back of the neck when patient is supine. Check ties to make sure they are tight enough to avoid slippage but loose enough to avoid jugular vein constriction or choking. If the patient has a Velcro tracheostomy tube holder, maintain secure hold on tracheostomy tube. Align strap under patient’s neck and secure with Velcro fastener. You should be able to slip only one or two fingers between the collar and neck.

12. If tube is cuffed, reinflate:
   a. Attach 5 mL syringe filled with air to the cuff pilot balloon.
   b. Slowly inject amount of air (usually 2-5 mL) necessary to achieve an adequate seal.
   c. Use a stethoscope during cuff inflation to gauge the proper inflation point. During inspiration, place the stethoscope on one side of patient's trachea. Use either minimal leak technique (small air leak or rush of air heard over larynx during peak inspiration) OR minimal occlusive cuff inflation technique (no air leak) for adequate cuff inflation.
   d. No air should be coming from mouth, nose or around tube.
   e. If the tubing does not have a one-way valve at the end, clamp the inflation line with a hemostat.
   f. Remove syringe.
   g. Check for air leaks from cuff. Air leaks may be present if you cannot inject the same amount of air withdrawn, if the patient can speak, and/or if the ventilator fails to maintain adequate tidal volumes.

13. Insert inner cannula and lock in place.
14. Check air exchange by holding hand over cannula.
15. If patient is ventilator dependent, connect to ventilator and observe for chest excursion.
16. Apply tracheostomy dressing around tracheostomy tube, if desired.
17. Discard soiled supplies in appropriate containers.

AFTER CARE:
1. Clean reusable equipment. (See Cleaning and Disinfection of Respiratory Equipment)
2. If tracheostomy tube is disposable, discard per agency policy.
3. Document in patient's record:
   a. Date and time of the procedure.
   b. Size and type of tube inserted.
   c. Quality and quantity of secretions.
   d. Assessment of the stoma site and surrounding skin.
   e. Patient's respiratory status.
   f. Duration of cuff deflation.
   g. Amount of air used for cuff inflation.
   h. Patient's response to procedure.
   i. Complications.
   j. Instructions given to patient/caregiver.
   k. Patient/caregiver understanding of instructions.
   l. Patient’s response to procedure.
   m. Communication with physician.
Respiratory – Ultrasonic Nebulizer Use

Strength of Evidence Level: 3

PURPOSE:
To deliver large volumes of wetting agents to the lungs for the purpose of mobilizing thick secretions and creating productive coughing.

CONSIDERATIONS:
1. The nebulizer converts an electric current to sound waves. These sound waves transform water into fine mist particles, which form a dense fog.
2. Since the nebulizer delivers a large volume of fluid to the lungs, the patient must be observed for signs of over hydration:
   a. Pulmonary edema.
   b. Rales.
   c. Electrolyte imbalance.
   d. Weight gain.
3. Ultrasonic treatments might trigger bronchospasms in patients with asthma.
4. To prevent mechanical hazards, only equipment recommended by the manufacturer should be used. If any defect is suspected or observed in the device, the medical equipment supplier should be notified immediately.
5. The electrical equipment should be properly grounded. Extension cords should not be used unless the use and type of cord is approved by the manufacturer or supplier.
6. Nebulizer should be placed where there is adequate ventilation to prevent unit from overheating.
7. If nebulizer is powered by an oxygen source, all oxygen precautions should be observed.
8. Since a large volume of mist is delivered directly into the lungs, scrupulous attention must be given to cleaning and care of equipment to reduce bacterial contamination.

EQUIPMENT:
Ultrasonic nebulizer
Oxygen tubing
Mouthpiece or mask
Sterile distilled water
Suction equipment (optional)
Cleansing agent
Wetting agent
Gloves and other protective equipment, as necessary

PROCEDURE:
1. Adhere to Standard Precautions.
2. Explain procedure to patient.
3. Review order for use of ultrasonic nebulizer, which should include:
   a. Type of wetting agent.
   b. Frequency of use.
   c. Mode of aerosol delivery (mouthpiece or mask).
   d. Duration of use, i.e., one month, six months.
   e. Length of treatment.
   f. Diagnosis and medical necessity.
4. Prepare nebulizer for use:
   a. Fill nebulizer cup with prescribed wetting agent or sterile distilled water; attach to nebulizer.
   b. Attach breathing tubing to ultrasonic nebulizer or oxygen source.
   c. After solution has been added to nebulizer cup, turn nebulizer on and observe for visible mist production.
   d. If no visible mist is produced:
      (1) Check electrical connection.
      (2) Check to verify that all switches are on.
      (3) Check water levels in reservoir and coupling chamber.
      (4) Check air supply and check for obstruction in breathing tubing or mouthpiece.
5. Apply mask or mouthpiece.
6. Encourage patient to breathe slowly and deeply with a brief pause (2 to 3 seconds) before breathing out, so the mist can penetrate to the lower bronchial tree.
7. Assess vital signs, observe for rales and wheezes.
8. At conclusion of treatment, encourage coughing and expectoration of secretions. Suctioning may be required.
9. Discard soiled supplies in appropriate containers.

AFTER CARE:
1. The ultrasonic nebulizer cup, delivery tubing, mask and/or mouthpiece should be disinfected daily. (See Respiratory - Cleaning and Disinfection of Respiratory Equipment.)
2. Medications should be stored in a cool, dry place. Teach patient to check them often for change in color or formed crystals.
3. Document in patient's record:
   a. Date, time, duration of therapy.
   b. Medication administered.
   c. Findings of respiratory assessment.
   d. Patient's response to procedure.
   e. Mucous viscosity and production.
   f. Instructions given to patient/caregiver.
   g. Patient/caregiver understanding of instructions and equipment set up and maintenance.
   h. Patient and caregiver understanding of safety practices.
4. Refer to manufacturer's instructions for equipment maintenance.
### Self-Management for COPD

- **GREEN ZONE = ALL CLEAR**
  - No cough, wheeze, chest tightness, or shortness of breath during the day or night
  - No decrease in your ability to maintain normal activity

- **GREEN ZONE MEANS:**
  - Your symptoms are under control
  - Continue taking your medications as ordered
  - Follow low salt diet
  - Keep all physician appointments

- **YELLOW ZONE = CAUTION**
  - Sputum (phlegm) that increases in amount or color or becomes thicker than usual
  - Increased cough or wheezing even after you take your medication and it has time to work
  - Increased swelling of ankles or feet
  - Increased shortness of breath with activity
  - Weight loss or gain of 3 lbs.
  - Fever of 100.5F oral or 99.5F under your arm
  - Increased number of pillows needed to sleep or need to sleep in chair
  - Anything else unusual that bothers you
  - Call your Home Health Nurse and/or Physician if you are in the yellow zone.

- **YELLOW ZONE MEANS:**
  - Add “Quick Relief Medicine” _____________
  - Your symptoms may indicate that you need an adjustment in your medication
  - Call your Home Health Nurse or Physician

- **RED ZONE – “MEDICAL ALERT”**
  - Unrelieved shortness of breath
  - Unrelieved chest pain
  - Wheezing or chest tightness
  - Increased or irregular heart beat
  - Change in color of your skin, nails beds, or lips to gray or blue
  - Mental changes
  - Chest pain or pain that worsens when you breathe or cough

**CALL YOUR PHYSICIAN AND/OR HOME HEALTH NURSE IF YOU ARE IN THE RED ZONE**

**IN AN EMERGENCY SITUATION CALL 911**

**RED ZONE MEANS**

- This indicated that you need to be evaluated by a physician right away.

**Primary MD______________________________**
**Telephone______________________________**

**Agency Name**
**Agency Phone Number**

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**Agency Name (ZONE tool utilized by HomePlus in Elkins, WV)**

Last Update 9/10
## Self Management Plan for Respiratory Disease

**Agency Name (ZONE tool utilized by HomePlus Elkins, WV)**

### Green Zone = “All Clear”
- No shortness of breath
- No need to use your rescue inhalers
- No decrease in your ability to maintain normal activity level

### Green Zone Means:
- Your symptoms are under control
- Continue taking your medications
- Continue using your inhaler and / or nebulizer
- Keep your Home Care Nurse appointments
- Keep physician appointments

### Yellow Zone = “Caution”
If you have any of the following signs or symptoms:
- Increased shortness of breath, which is relieved with fifteen minutes of rest
- Increased cough and / or your mucus changes in color, consistency or amount
- Increased shortness of breath with activity
- Increased tiredness without any reason
- Irritability, confusion and / or headaches
- Increased number of pillows needed to sleep or need to sleep in a chair
- You have a temperature of 100.5° or greater

### Yellow Zone Means:
- Your symptoms indicate that you may need an adjustment in your medications and / or treatments
- You may have a Respiratory infection
- Call your Home Health Nurse and/or your physician

**Agency Name**

24 hour phone number is: **Agency Phone Number**

**Primary MD:** ____________________________
**Phone Number:** ____________________________

*(Please notify your Home Care Nurse if you contact or go see your MD)*

### Red Zone = “Medical Alert”
- Unrelieved shortness of breath even after taking your medication and treatments
- Increased confusion
- Wheezing or chest tightness at rest
- You have trouble walking
- Mental changes
- You have trouble staying awake
- Your lips or fingernails are blue or gray

### Red Zone Means:
**Call 911 immediately**

**Agency Name**

24 hour phone number is: **Agency Phone Number**

**Primary MD:** ____________________________
**Phone Number:** ____________________________

*(Please notify your Home Care Nurse if you go to the emergency room or are hospitalized)*
REFERENCES


ON%2FFlexMember%2FShow_Public_HFFY&c=FlexGrouphttp://www.uwhealth.org/servlet/.