



Collecting a Sputum Specimen

Geisinger Medical Laboratory

Microbiology

10X Essentials Training

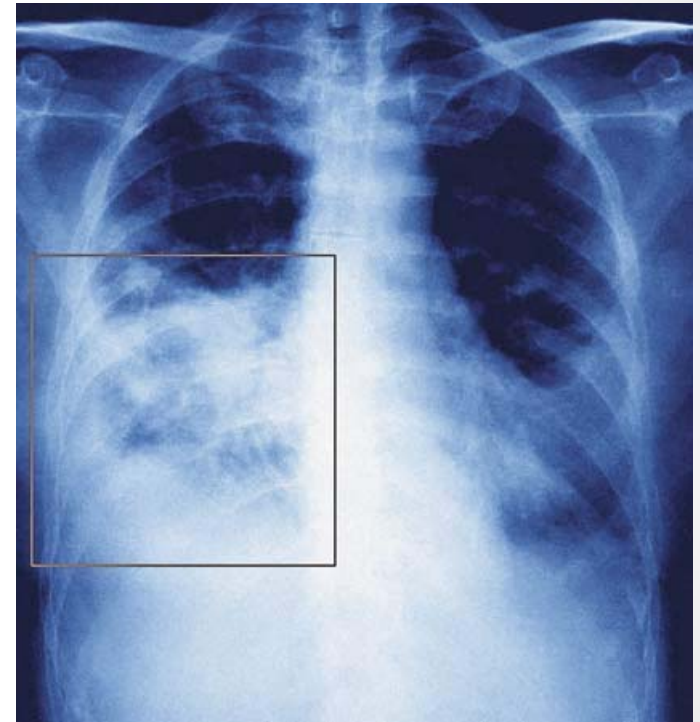
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Pneumonia Background

- 6th most common cause of death in U.S.
- 1-year mortality as high as 40% for community-acquired pneumonia (CAP) patients in Medicare
- Median mortality of all in-patients as high as 30%
- Anevlavis et al 2009, Albert 2008, Puligandla et al 2008



Why Sputum from My Patient?

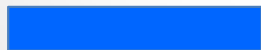
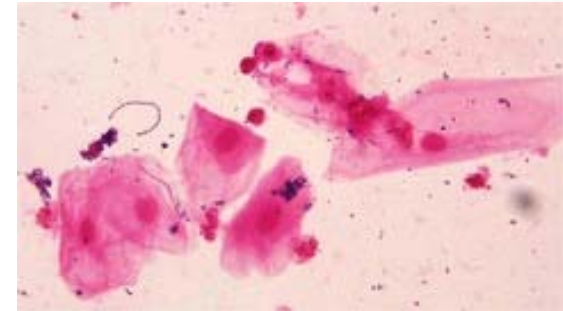
- Testing sputum helps diagnose infection like pneumonia, bronchitis, tuberculosis, and lung abscess.
- For sputum to be useful for culture and proper treatment:
 - It must come from deep within the lungs.
 - It must be of sufficient quantity - at least 15 mL is preferred.
- For tuberculosis (AFB Culture), it may be necessary to obtain as many as three sputum specimens before the pathogen can be determined and the appropriate treatment initiated. Three (3) specimens are collected at a minimal interval of 8 to 24 hours, with 1 specimen being a first morning specimen, which is recommended for adequate recovery.

Respiratory Sample Quality Assessment

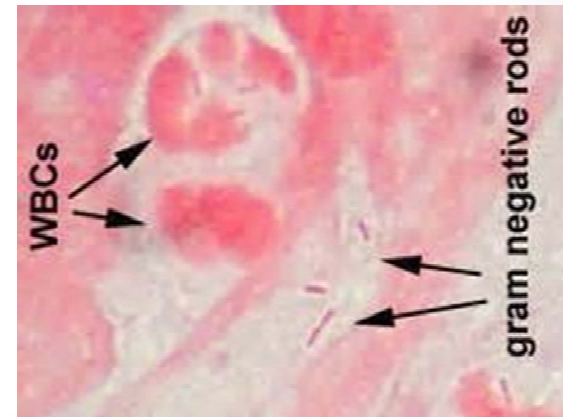
Samples that are grossly contaminated with saliva and oral epithelia cells are rejected according to national standards for respiratory sample quality as they do NOT yield clinically useful information



Rejected, > 10 squamous cells/high power microscope field (HPF)



Acceptable: < 10 squamous cells/HPF
Presence of inflammatory cells, is not required but is indicative of proper collection in non-neutropenic patients



Specimen quality greatly impacts accuracy.

- Based upon Geisinger statistics, respiratory specimens are rejected 25% of the time, delaying patient results and creating re-work for nursing and laboratory services.
- Sputum samples are ~ 6 X MORE likely to be rejected for poor quality than are tracheal aspirates.
 - Nationally, sputum rejection rates range from 6- 64%.
 - Geisinger sputum rejection rates range from 20% to 53% of over 2,400 specimen/year
- Minimum goal/ unit is 65% acceptable sputum; stretch goal = 75% acceptable



Anevlavis et al 2009; Telgen et al 2010; Stralen 2008; Isenberg, Clin Micro Procedures 2004; Shariatzadeh et al 2009; Moncayo-Nieto et al 2013; Miyashita et al, 2008; Garcia-Vazquez et al 2004; Lagerstrom et al 2004; Geckler, R.W. et al, 1977

Tip to Obtain a High Quality Sputum Specimen

- There are two types of non-intubated patients for which a sputum specimen may be requested.
 1. Patients with a strong cough, who have the potential to provide a proper sputum specimen by expectorating into a sterile cup.
 2. Patients unable to produce as strong cough, who are NOT likely to provide an adequate sputum specimen – they may require nasotracheal suctioning.



BEST PRACTICES FOR COLLECTING A COUGHED SPUTUM SAMPLE INTO A CUP

Before Collection

1. If your patient is not on a fluid restriction, have them drink plenty of fluids on the evening before the sputum collection to boost sputum production overnight.
2. For best results, obtain the sputum sample **first thing in the morning**.
NOTE: Do NOT allow patient to brush teeth or use mouthwash before collection.
3. If you can't obtain the sample before the patient has breakfast, wait at least an hour after eating to collect sample.
4. **Before you begin, describe the procedure in full.**



Prepare for Collection

5. Once the patient understands the procedure and all questions are answered to patient satisfaction, set up your equipment at the bedside.

- Emesis basin
- Labeled sterile specimen cup with a tight-fitting cap (≥ 2 patient identifiers, specimen source, date and time of collection)
- Gloves, gown, and face protection



6. If difficult collection is anticipated: To help loosen tenacious secretions, have an aerosol of 10% sodium chloride or sterile water on hand to administer via nebulizer if needed.



Instruct Your Patient

7. Remove dentures, if they have them.

8. Position your patient in a chair or on the side of the bed. If unable to sit up on their own, place them in a high-Fowler's position.

9. Have the patient rinse their mouth with plain water so that they don't contaminate the sputum being coughed up with the bacteria in their mouth.

10. Explain that deep breathing helps loosen secretions. Emphasize the importance of bringing up sputum, the thick secretions from the lungs, rather than expectorating saliva, the thin secretions from the mouth.



11. Don protective eyewear and gloves. Uncap the sterile container, avoiding touching the inside to ensure that it's kept sterile.
12. **Instruct the patient to take at least three deep breaths, then force out a deep cough**, expectorating the sputum into the container.
13. If you don't get an adequate sample on the first try, have the patient continue to cough until you're able to collect a minimum of 15 mL. If the patient has trouble bringing up secretions, have them breathe into the nebulizer and try again.
14. Once you've collected the specimen, securely cap the container. Remove and discard your gloves and wash your hands thoroughly. Allow the patient to rinse out their mouth and provide a tissue.
15. Send the labeled sample to the laboratory immediately, without refrigeration.



Rejected Sputum Specimens



- The local Microbiology laboratory will reject sputum samples that have too many epithelial cells and are indicative of heavy saliva contamination. Your report will indicate that the culture will not be performed unless a more adequate specimen is collected
 - White blood cells (WBC), suggesting inflammation from bacterial infections in actual sputum are expected, but the laboratory does NOT reject specimens based on the lack of WBC. This is because neutropenic patients may not have high WBC present.
- NOTE: Rejected sputum specimens are useless for culture as they don't correlate with the cause of infection. Furthermore, too much saliva contamination results in misleading information for the providers, who may end up treating normal mouth bacteria based on faulty results. This places your patients at risk for drug resistant microbes or *Clostridium difficile* infections.

Consider their chances?

- If a patient is frail or unable to produce a high quality sputum specimen the first time, (the laboratory will reject the specimen due to poor specimen quality), the chances of having a second specimen be rejected for poor quality are increased.



- In those cases, **nebulizer assistance, suction or tracheal aspiration** may produce a better specimen

BEST PRACTICES COLLECTING A SPUTUM SAMPLE USING SUCTION

Nasotracheal suctioning

1. Nasotracheal suctioning is your alternative for patients who are obtunded or whose cough is weak. Suctioning can produce a more reliable sample because it helps you bypass the normal bacterial flora in the mouth.

NOTE: The use of suction is contraindicated in several clinical situations, such as chronic heart disease, as suctioning can induce dysrhythmias.

2. Assess the patient's cardiac and respiratory status to be sure they can tolerate the procedure. (Don't proceed if you detect any recent changes from baseline respiratory rate, breath sounds, oxygen saturation, or heart rate and rhythm.)

Nasotracheal suctioning

3. Start by explaining the procedure, describing that it requires the insertion of a catheter through the nose and into the back of the throat or trachea.
4. Warn the patient that they may cough, gag, or feel as if they can't catch his breath during the procedure, but should not feel any pain. Reassure them that these are normal responses.

Nasotracheal suctioning

5. Gather the supplies and set them up at the bedside.

- Sterile suction set: 12 – 14 French (Fr) for adults; 10Fr, 8Fr, 6Fr for smaller airways (from distribution) - contains suction catheter, sterile gloves and basin.
- Portable suction machine from distribution if wall suction not available.
- Sterile water or Normal Saline Solution (NSS) for irrigation
- 6 foot Connecting Tubing
- Water-soluble lubricant
- Personal Protective Equipment (PPE): sterile gloves, gown, mask, goggles
- Oxygen Source, Oxygen Mask capable of delivering high concentrations of oxygen or bag valve mask.
- Sterile in-line specimen trap.

Nasotracheal suctioning

6. If you don't have wall suction and oxygen, you'll also need a properly functioning suction machine and an oxygen delivery system. Have a resuscitation bag ready, as well as a pulse oximeter and other monitoring equipment, depending upon the patient's condition.
7. Position patient upright in a chair or in bed in a semi- or high-Fowler's position, and administer oxygen by face mask until you are ready to insert the catheter. Put on your mask and goggles and open the equipment, taking care not to contaminate the items.

Nasotracheal suctioning

8. Connect one end of the suction tubing to the wall or machine's suction port. Attach the other end to the male adapter of the in-line specimen trap.
9. Don your sterile gloves.
10. Attach the free end of the suction catheter to the trap's rubber tubing, keeping the catheter sterile. Next, test the suction by briefly dipping the end of the catheter into the sterile water and applying suction. If it's working properly, you're ready to obtain the sample.
- 11. Gently insert the catheter**

Nasotracheal suctioning

12. Instruct your patient to slightly tilt their head back. Dip the tip of the catheter into the lubricant and carefully put it into one of their nares.
13. When the tip of the catheter reaches the back of the throat, the patient may cough. As they coughs, quickly but gently advance the catheter into the trachea. Instruct the patient to take several deep breaths through their mouth to ease insertion.
14. Have them give you a deep cough, and apply suction at a pressure of 100 – 150 mm Hg for 5 to 10 seconds —but never for more than 15 seconds.

Note: Higher pressures applied for longer periods can result in hypoxemia and atelectasis and may cause trauma to the trachea.

Nasotracheal suctioning

15. If you're unsuccessful on your first attempt, stop the suction and pull back the catheter slightly. Let the patient rest for four to six breaths before trying again.

Note: Stop the procedure immediately and administer supplemental oxygen if patient becomes distressed or cyanotic.

16. Once you have collected the sample, stop the suction, gently remove the catheter, and administer oxygen, as directed.

17. Detach the suction catheter from the rubber tubing on the in-line trap. Discard the catheter.

Note: Rarely, a patient who cannot tolerate nasotracheal suctioning will require a bronchoscopy to obtain a sputum specimen.

Nasotracheal suctioning

18. Observe for hypoxia, changes in heart rhythm, uncontrolled coughing, vomiting, or broncho- or laryngospasm after this procedure. Look, for any trauma caused by the suction catheter, such as bleeding from the nose or pharynx.
19. Disconnect the suction tubing from the trap and tightly seal the trap by placing the rubber tubing over the male adapter.
20. Record the date and time of the sputum aspirate collection, 2 patient identifiers and note which method you used. Send the labeled sample to the laboratory immediately, without refrigeration.

Preparation for Suctioning Artificial Airways

1. Wash hands.
2. Turn on suction apparatus and set vacuum regulator to appropriate negative pressure.
 - Infant 60-80 mmHg
 - Child 80-100 mmHg
 - Adult 100-120 mmHg
3. Don eye goggles or glasses, and mask.

Preparation for Suctioning Artificial Airways

4. Select appropriately sized suction catheter. Catheter should not be any larger than one-half the diameter of the endotracheal / tracheostomy tube.

Patient / ET tube size:

- infant (2.5-3.5)
- infant / small child (4.0–4.5)
- child / small adult (5.0-7.5)
- average adult (8.0-9.5)

Suction Catheter size:

- 6 French (Fr)
- 8 French
- 10 French
- 14 French



Preparation for Suctioning Artificial Airways

Tracheostomy tube size:

- 3.0mm
- 3.5mm
- 4.0mm
- 4.5mm
- 5.0mm
- 6.0mm
- 7.0mm



Recommended Suction Catheter size:

- 7 French
- 8 French
- 8 French
- 10 French
- 10 French
- 10-12 French
- 12 French



Preparation for Suctioning Artificial Airways

- The suction depth is determined by the length of the individual tracheostomy tube.
- The depth of insertion of the suction catheter needs to be determined prior to suctioning to avoid airway trauma.
- Using a spare tracheostomy tube of the same size and a measuring tape:
 - measure the distance from the length of the tracheostomy tube connector to the end of the tracheostomy tube.
 - record the suction depth on the tape measure and the patients observations chart.
 - attach the tape measure to the cot/bedside/suction machine for future use.

Preparation for Suctioning Artificial Airways

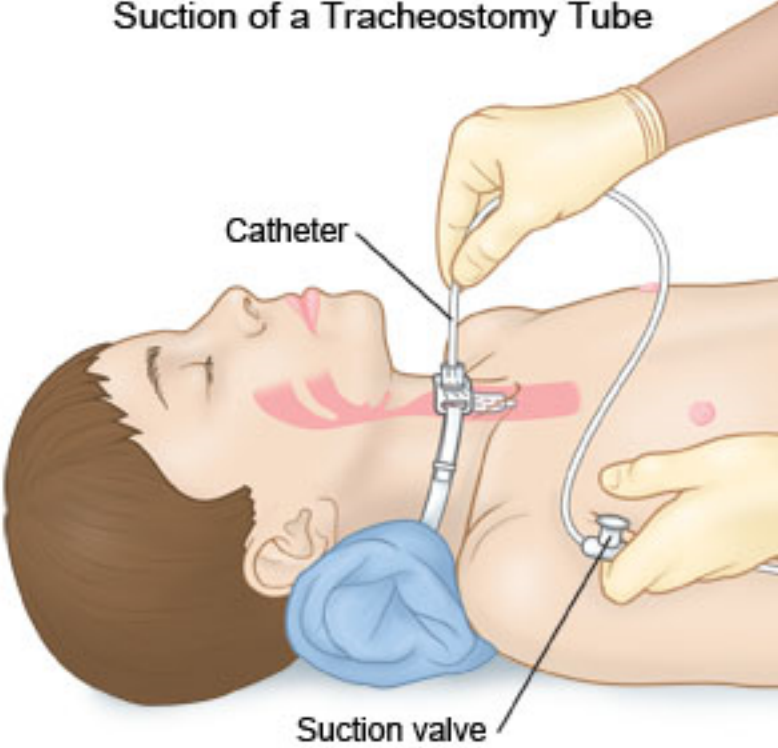
- Use pre - measured suction catheters(where available) to ensure accurate suction depth.
- The pressure setting for tracheal suctioning is 80-120mmHg to avoid tracheal damage. **The suction pressure setting should not exceed 120mmHg.**
- It is recommended that the episode of suctioning (including passing the catheter and suctioning the tracheostomy tube) is completed within 5-10 seconds.
- Suction catheters can be used for a 24hour period and then discarded unless indicated. Sterile catheters are preferred.

Preparation for Suctioning Artificial Airways

- **Routine** use of 0.9% sodium **chloride is not recommended** however, In situations where this may be of benefit e.g., thick secretions and to stimulate a cough 0.2 - 0.5ml of 0.9% sodium chloride can be used.
5. Secure one end of connecting tube to suction machine or wall suction, and attach the other end to the male adapter of the in-line specimen trap.
 6. Open sterile catheter package on a clean surface, using the inside of the wrapping as a sterile field. Connect catheter to specimen trap to complete the assembly process keeping the suction catheter sterile.
 7. Set up the sterile solution container or sterile field. Be careful not to touch the inside of the container. Fill with approximately 100 ml of normal sterile saline and/or water.

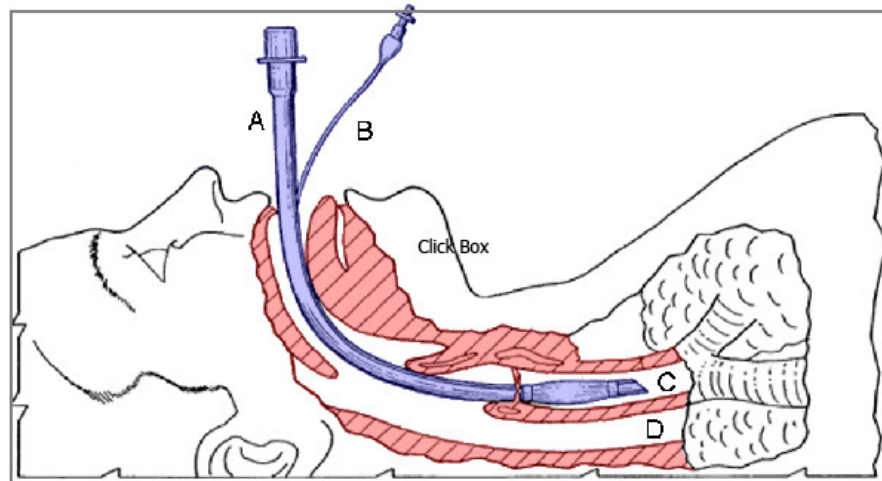
Tracheal Suctioning

Suction of a Tracheostomy Tube



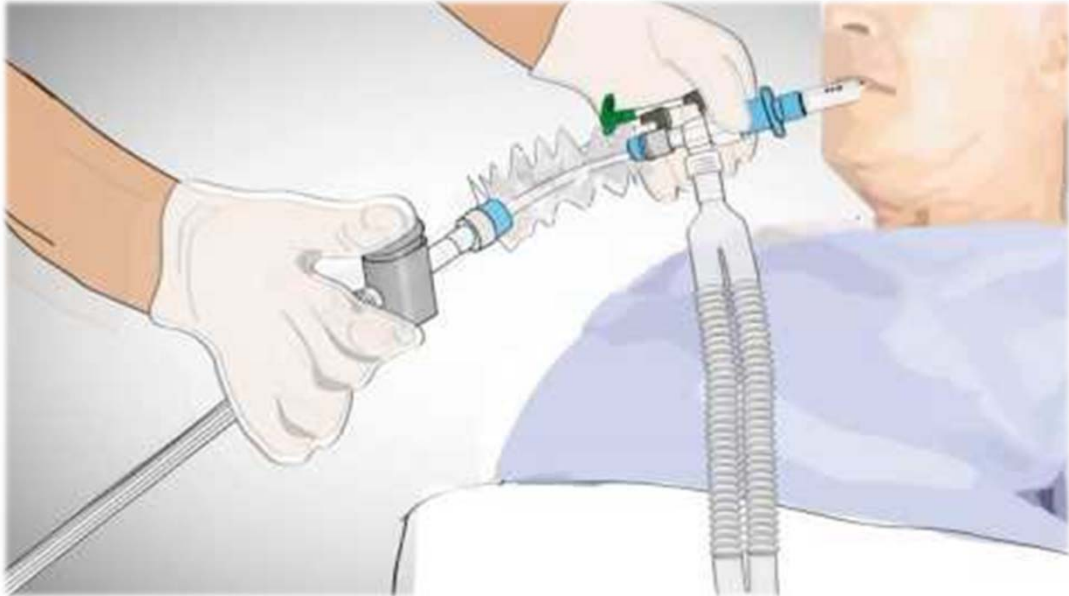
Endotracheal Suctioning

Endotracheal Specimen Collection



Click on the image above to be taken to Geisinger Medical Laboratories/Geisinger Proven Diagnostics Test Catalog for Endotracheal Specimen Collection.

Closed System Suctioning



Closed System Suctioning

The closed tracheal suction system is indicated for intubated / tracheal patients who:

- Are placed in respiratory isolation
- Require frequent suctioning (greater than 3 times per shift)
- Require greater than 10 cm H₂O positive end expiratory pressure (PEEP) and / or an oxygen concentration greater than 50%.
- Have documented desaturations demonstrated on pulse oximetry during suctioning.

Closed Tracheal Suction System for ETT/Trach

Set Up

1. Attach control valve to wall suction tubing.
2. Before attaching Trach Care Catheter to patient, depress Trach Care thumb control valve and set wall suction to desired suction.
3. Attach T-piece to ventilator circuit using the enclosed flex tube between circuit and T-piece.
4. 14 Fr Trach Care Catheter should be used with a 7.0 mm or larger tracheal tube. NOTE: Trach use 4.6 mm/30.5 cm. ETT use 4.6 mm/54 cm.
5. For sputum collection, connect specimen trap inline between the suction control valve and the suction tubing.
Note: Collection of sputum through closed catheters is only completely free of contaminants when first used.
6. Attach T-piece to ETT/trach.

Closed Tracheal Suction System for ETT/Trach

Suctioning Procedure

1. Grip T-piece with one hand. Advance catheter 4-5 inches down ETT/trach with thumb and forefinger of the opposite hand. To lavage, follow step two or continue to advance catheter to desired length.
2. Turn ventilator to 100% FIO2 or activate "suctioning" on vent settings.
3. Lavage patient by instilling NSS via the irrigation port after catheter has been advanced 4-5 inches. Do not apply suction during lavage. NSS packs for lavage are with set-up.
4. After advancing catheter to desired depth, depress control valve to apply suction. Maintain grip on T-piece. Gently withdraw suction catheter until *Black Marking* on catheter is visible at back of T-piece.

Closed Tracheal Suction System for ETT/Trach

5. Lift and turn thumb piece 180° to lock position on control while maintaining suction.
6. After suctioning flush catheter by depressing valve, then slowly introduce NSS through flush port while maintaining suction.
7. Place catheter and suction tubing along side breathing circuit.
8. Turn ventilator FIO2 to patients ordered setting.
9. Observe for hypoxia, changes in heart rhythm, hypotension, atelectasis, or broncho- or laryngospasm after this procedure. Look, for any trauma caused by the suction catheter, such as bleeding.

Closed Tracheal Suction System for ETT/Trach

10. Disconnect the suction tubing from the trap and tightly seal the trap by placing the rubber tubing over the male adapter. Reconnect inline suction tubing to the control valve tubing to complete the patient's circuit.
11. Record the date and time of the sputum aspirate collection, 2 patient identifiers and note which method (nasotracheal, tracheal, endotracheal) you used. Send the labeled sample to the laboratory immediately, without refrigeration.

Endotracheal / Tracheal Suctioning

For endotracheal tube and tracheostomy suctioning:

(14 Fr Trach Care Catheter should be used with a 7.0 mm or larger tracheal tube. NOTE: Trach use 4.6 mm/30.5 cm. ETT use 4.6 mm/54 cm.)

1. Don sterile glove(s).
2. Pick up suction catheter, being careful to avoid touching nonsterile surfaces. With the non-dominant hand, pick up connecting tubing. Attach specimen trap to suction connecting tubing. Secure the suction catheter to the specimen trap. Handle all nonsterile items with the non-dominant hand. The dominant hand should not come into contact with the connecting tubing.
3. Check equipment for proper functioning by suctioning a small amount of sterile saline from the container.

Endotracheal / Tracheal Suctioning

4. Hyperoxygenation with 100% O₂. (Used to offset hypoxemia during interrupted oxygenation and ventilation. Patients receiving positive end-expiratory pressure (PEEP) ventilation should be suctioned through an adaptor (closed system suction method).
5. With thumb off of the control vent of the catheter which results in the suction being off, gently but quickly insert catheter with dominant hand into artificial airway during inspiration until resistance is met; then pull back 1 cm. If secretions are thick and sticky, instill 3 ml of sterile saline lavage down the artificial airway.

Note: Application of suction pressure upon insertion increases hypoxia and results in damage to the tracheal mucosa.

Endotracheal / Tracheal Suctioning

6. Apply intermittent suction by placing and releasing non-dominant thumb over the control vent of the catheter. Rotate the catheter between dominant thumb and forefinger as you slowly withdraw the catheter.

Note: Entire suction pass can be safely carried out for up to 15 seconds without incurring serious drops in oxygenation.

7. Replace oxygen delivery device. Hyperoxygenate following suction procedures and between passes of the suction catheter.

Note: Recovery to baseline PaO₂ takes 1 to 5 minutes.

8. Rinse catheter and connecting tubing with normal saline until clear.

Endotracheal / Tracheal Suctioning

9. Repeat steps 4-8 as often as necessary to clear secretions for specimen.
10. Disconnect the suction tubing from the trap and tightly seal the trap by placing the rubber tubing over the male adapter.



Endotracheal / Tracheal Suctioning

11. Once the lower airway has been adequately cleared of secretions, perform nasal and oral pharyngeal or upper airway suctioning.

Note: The catheter is contaminated following nasal and oral pharyngeal suctioning and should not be inserted into the endotracheal or tracheostomy tube.

12. Discard catheter.

13. Check ventilator settings to assure patient is returned to ordered FIO₂ if increased to 100% for hyperoxygenation.

14. Record the date and time of the sputum aspirate collection, 2 patient identifiers and note which method you used. Send the labeled sample to the laboratory immediately, without refrigeration.

Endotracheal / Tracheal Suctioning

Name _____
Hosp. No. _____
Date _____ Time _____
Rm. _____ Drawn By _____



REFERENCE SOURCES

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