

Specimen Collection: Sputum (Pediatric) – CE

ALERT

Suctioning may cause direct stimulation of vagal nerve fibers, especially in an infant.

Don appropriate personal protective equipment (PPE) based on the patient's signs and symptoms and indications for isolation precautions.

OVERVIEW

Sputum is produced by cells lining the respiratory tract. Although production is minimal in the healthy state, disease states can increase the amount or change the character of sputum.

Examination of sputum may aid with diagnosing and treating various conditions.

In many cases, suctioning is indicated to collect sputum from a young child. Suctioning may also be necessary for children with developmental delays, regardless of age. A cough can possibly be elicited by tickling the back of the child's throat with the suction catheter. In addition to direct stimulation of vagal nerve fibers, suctioning may provoke coughing, vomiting, and aspiration of stomach contents and induce pharyngeal, laryngeal, and bronchial muscle constriction. In children with endotracheal (ET) or tracheostomy tubes, sputum is easily aspirated from the trachea. Adolescents and older children are usually able to produce a sputum specimen by coughing if they are given very clear instructions.

Sputum for cytology, culture and sensitivity, and acid-fast bacilli (AFB) are the three major types of sputum specimens. Cytologic or cellular examination of sputum may identify aberrant cells or cancer. The most common types of diagnostic tests performed on sputum specimens include respiratory syncytial virus, influenza A and B, parainfluenza, rhinovirus, and enterovirus.

Sputum collected for culture and sensitivity testing can be used to identify specific microorganisms to determine which antibiotics are the most sensitive. The AFB smear is used to support a diagnosis of tuberculosis (TB). A definitive diagnosis of TB also requires a sputum culture and sensitivity. Regardless of the test ordered, a sputum specimen should be collected first thing in the morning due to a greater accumulation of bronchial secretions overnight.

CHILD AND FAMILY EDUCATION

- Provide individualized, developmentally appropriate education to the family and child based on the desire for knowledge, readiness to learn, and overall neurologic and psychosocial state.
- For an older child, demonstrate effective coughing techniques versus clearing of the throat.
- Demonstrate the splinting technique for a child with abdominal or thoracic incisions.
- Explain to the child and family the purpose of avoiding the use of mouthwashes and toothpaste before sputum expectoration.
- If an aerosol treatment is indicated, teach the child and family the purpose of the procedure, explaining that it stimulates coughing and sputum expectoration.
- Instruct the child and family to avoid contaminating the outside of the specimen cup to reduce the risk of spreading infection.
- Encourage questions and answer them as they arise.

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ASSESSMENT AND PREPARATION

Assessment

1. Perform hand hygiene before patient contact and don PPE as indicated for needed isolation precautions.
2. Introduce yourself to the child and family.
3. Verify the correct child using two identifiers.
4. Check the practitioner's orders for the type of sputum analysis and specifications (e.g., amount of sputum, number of specimens, time of collection, method of obtaining specimens) and initiate appropriate isolation precautions until the results are obtained.
5. Assess the child's ability to cough and expectorate a specimen.
6. Determine when the child last ate or had a tube feeding. Suctioning or coughing up secretions can trigger the gag reflex. If the child has recently eaten, this may also trigger vomiting.
7. Determine the type of assistance the child needs to obtain a specimen.
8. Assess the child's respiratory status, including respiratory rate, depth, and pattern, and the color of mucous membranes.
9. Assess the child's and family's understanding of the reasons for and the risks and benefits of the procedure.

Preparation

1. Gather the necessary supplies, including the appropriate personal protective equipment (PPE). Take airborne precautions when caring for a child who is suspected of having TB or other airborne transmissible diseases.
2. Determine the child's ability to assist with the collection of the specimen.
3. Demonstrate deep breathing and expectoration.

Stress the importance of deep coughing and of not clearing the throat if the child is expectorating sputum. Have a health care team member or family member secure the child's head and hands if suctioning will be used to obtain a specimen.

4. For the collection of an expectorated specimen, ensure that the child rinses his or her mouth or brushes his or her teeth with water, as developmentally appropriate.

Ensure that the child does not use mouthwash or toothpaste because they may decrease the viability of the microorganisms and alter the culture results.

5. Position the child appropriately, depending on the specimen collection method.
 - a. To collect the specimen via coughing and expectoration, position the child in the semi-Fowler position, sitting on the side of the bed, in a chair, or standing.
 - b. To collect the specimen using suction, position the child in the high- or semi-Fowler position and allow him or her to sit in a family member's or the assistant's lap, if possible.

Rationale: The semi-Fowler position promotes full lung expansion and aids the ability to cough.

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PROCEDURE

Sputum Collection Using the Coughing and Expectorating Method

1. Perform hand hygiene and don gown, mask, eye protection or face shield, and gloves. If necessary, ensure that an assistant is available and wearing appropriate PPE.
2. Verify the correct child using two identifiers.
3. Explain the procedure to the child and family and ensure that they agree to treatment.
4. Provide the child with the specimen container (e.g., sputum trap) or have the assistant hold the container. Instruct the child or family member not to touch the inside of the container.
5. Instruct the child to take a slow, deep breath and to cough after a full inhalation.

Rationale: Expectorant must come from the lungs. Saliva is not sputum.³

6. Instruct the child to expectorate sputum directly into the specimen container.
7. Instruct the child to repeat coughing until a sufficient quantity (a minimum of 5 ml of sputum) is collected.³
8. Secure the top on the specimen container tightly.
9. Offer the child tissues after he or she expectorates. Dispose of the tissues in an emesis basin or appropriate waste receptacle.
10. Wipe off any sputum present on the outside of the container with an organization-approved disinfectant wipe.

Ensure that the container is tightly closed before wiping to prevent contamination of the specimen.

11. Offer the child mouth care, if desired.
12. Label the specimen at the child's bedside and in the presence of the family (if they are at the bedside), per the organization's practice.²
13. Prepare the labeled specimen for transport.
 - a. Place the labeled specimen in a biohazard bag.
 - b. If the specimen requires ice for transport, place the specimen in a biohazard bag, then place the bag with the specimen into a second biohazard bag filled with ice slurry.

Rationale: Placing the specimen in a separate bag protects the label from being damaged.

14. Immediately transport the specimen to the laboratory.
15. Discard supplies, remove PPE, and perform hand hygiene.
16. Document the procedure in the child's record.

Sputum Collection Using Suction

1. Perform hand hygiene and don gloves and appropriate PPE based on the patient's signs and symptoms and indications for isolation precautions.
2. Verify the correct child using two identifiers.
3. Explain the procedure to the child and family and ensure that they agree to treatment.

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4. Prepare the suction machine or device and ensure that the suction source is functioning properly.
 - a. Ensure that the proper size suction catheter is used based on the child's size and the catheter's comfortable fit in the nares.
 - b. Set the vacuum regulator between 60 and 100 mm Hg (recommended for infants and children).¹
5. Connect the suction tubing to the adapter on the sputum trap.
6. If using a sleeved suction catheter, remove the suction tubing from the end of the catheter and connect it to the sputum trap.

Rationale: Connecting the suction tubing to the sputum trap establishes suction that passes through the sputum trap to aspirate a specimen.

7. Perform hand hygiene and don gown, mask, eye protection or face shield, gloves. Don sterile gloves and eye protection if a regular sterile suction catheter will be used.

Rationale: The tracheobronchial tree is a sterile body cavity. Sterile gloves allow for manipulating the suction catheter without contaminating it.

Sterile gloves and eye protection are not required if a sleeved suction catheter is used.

8. Connect the regular sterile suction catheter or the end of the sleeved suction catheter to the rubber tubing on the sputum trap.

Rationale: Connecting the sterile suction catheter or the sleeved suction catheter to the rubber tubing on the sputum trap allows aspirated sputum to go directly to the trap instead of to the suction tubing.

9. Apply a small amount of sterile, water-soluble lubricant to the end of the suction catheter if suctioning through the nasopharynx.
10. Instruct the child to breathe normally during suctioning to prevent hyperventilation. Explain to the child that he or she may cough.
11. Have the assistant position the child so that the assistant has control of the child's head and hands.
12. Instruct the child to cough before the procedure begins, if developmentally appropriate.

Rationale: Having the child cough allows secretions to gather and loosen before they are suctioned with the catheter.

13. Gently insert the tip of the suction catheter through the nasopharynx, the ET tube, or tracheostomy tube without applying suction.

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Rationale: Inserting the catheter without applying suction decreases the chances of trauma to the mucosa.

Advance the suction catheter only to the point of resistance in the nares.

14. Advance the catheter into the trachea gently and quickly.

Rationale: Entering the larynx and trachea triggers the cough reflex.

15. Apply suction by placing the thumb of the nondominant hand over the suction port of the regular suction catheter or by depressing the suction button of the sleeved suction catheter for 5 to 10 seconds as the child coughs.¹ Limit suctioning to less than 5 seconds for infants and up to 10 seconds for children.¹

Rationale: Rotating the catheter during withdrawal minimizes mucosal damage.

16. Apply suction only while withdrawing the catheter from the insertion site. Maintain sterility when suctioning the ET or tracheostomy tube site.

Limit the duration of each suction pass to less than 10 seconds and limit the number of passes to a maximum of three to help minimize hypoxemia, airway trauma, and cardiac arrhythmias.¹

If the child becomes hypoxic during the procedure, discontinue the procedure immediately and provide supplemental oxygen.

17. Release the suction and withdraw the catheter.

Rationale: Suction can damage mucosa if it is applied during withdrawal.

If another suction pass is needed, give the child 30 to 60 seconds to recover.¹

18. Turn off the vacuum regulator.
19. Evaluate the child immediately after the procedure. Observe for any shortness of breath or signs of hypoxemia.
20. Detach the catheter from the specimen trap.
 - a. Dispose of the catheter in the appropriate receptacle if using a regular suction catheter.
 - b. Reconnect the suction tubing to the end of the catheter if using a sleeved suction catheter.
21. Detach the suction tubing and connect the rubber tubing on the sputum trap to the plastic adapter ([Figure 1](#)).
22. Wipe off any sputum present on the outside of the container with an organization-approved disinfectant wipe.

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Ensure that the sputum trap is tightly sealed before wiping to prevent contaminating the specimen.

23. Offer the child mouth care, if desired.
24. Label the specimen at the child's bedside and in the presence of the family (if they are at the bedside), per the organization's practice.²
 - a. Place the labeled specimen in a biohazard bag.
 - b. If the specimen requires ice for transport, place the specimen in a biohazard bag, then place the bag with the specimen into a second biohazard bag filled with ice slurry.

Rationale: Placing the specimen in a separate bag protects the label from being damaged.

25. Immediately transport the specimen to the laboratory.
26. Discard supplies, remove PPE, and perform hand hygiene.
27. Document the procedure in the child's record.

MONITORING AND CARE

1. Observe and monitor the child's respiratory status throughout the procedure, especially during suctioning.

Rationale: Excessive coughing or prolonged suctioning can alter the respiratory pattern and cause hypoxemia.

2. Allow the family to comfort the child. If the family is not available, have a health care team member comfort the child.

Rationale: The procedure may be uncomfortable and scary for a child.

3. Continue to observe the character of the sputum, including color, consistency, odor, volume, and viscosity, and look for blood.

Rationale: Abnormal sputum characteristics may indicate disease entities.

Report unusual sputum characteristics or changes in the characteristics of the sputum to the practitioner.

4. Refer to the laboratory reports for test results.
 - a. Report abnormal findings to the practitioner.
 - b. Initiate appropriate isolation techniques if an AFB sputum culture is positive.

Rationale: An AFB culture indicates whether abnormal cells or microorganisms are in sputum.

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5. Assess, treat, and reassess pain.

EXPECTED OUTCOMES

- Child's respirations are the same rate and character as before procedure.
- Child or family is able to discuss purpose and benefit of sputum collection.
- Adequate sputum sample is obtained.
- Sputum is not contaminated by saliva or oropharyngeal flora.
- Laboratory test results do not reveal abnormal cells or microorganisms.
- Child maintains adequate oxygen saturation levels.
- Child tolerates procedure without pain or discomfort.

UNEXPECTED OUTCOMES

- Child becomes hypoxic, requires increased respiratory rate and effort, or feels short of breath.
- Oxygen saturation levels drop after procedure and do not improve after procedure is completed.
- Child experiences arrhythmia after suctioning.
- Child remains anxious or expresses discomfort resulting from suction catheter.
- Specimen contains saliva.
- Specimen contains blood, pathogenic organisms, or abnormal cells.
- Inadequate amount of sputum is collected.
- Child complains of or exhibits pain when coughing to produce sputum.
- Nasopharynx mucosal lining is damaged or edematous.

DOCUMENTATION

- Method used to obtain specimen
- Date and time of collection, type of test ordered, and laboratory receiving specimen
- Characteristics of sputum specimen
- Child's tolerance of procedure
- Isolation precautions in use (if positive AFB sputum culture)
- Unexpected outcomes and related interventions
- Child and family education

REFERENCES

1. Brown, T.L. (2017). Chapter 20: Pediatric variations of nursing interventions. In M. Hockenberry, D. Wilson, C.C. Rodgers (Eds.), *Wong's essentials of pediatric nursing* (10th ed., pp. 575-635). St. Louis: Elsevier.
2. Joint Commission, The. (TJC). (2020). National patient safety goals effective 2020: Hospital accreditation program. Retrieved March 10, 2020, from https://www.jointcommission.org/-/media/tjc/documents/standards/national-patient-safety-goals/npsg_chapter_hap_jan2020.pdf (Level VII)
3. Pagana, K.D., Pagana, T.J. (2018). Chapter 7: Microscopic studies and associated testing. In *Mosby's manual of diagnostic and laboratory tests* (6th ed., pp. 638-720). St. Louis: Elsevier.

Elsevier Skills Levels of Evidence

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- Level I - Systematic review of all relevant randomized controlled trials
- Level II - At least one well-designed randomized controlled trial
- Level III - Well-designed controlled trials without randomization
- Level IV - Well-designed case-controlled or cohort studies
- Level V - Descriptive or qualitative studies
- Level VI - Single descriptive or qualitative study
- Level VII - Authority opinion or expert committee reports

SUPPLIES

- Patient identification labels
- Completed laboratory requisition, including child's name, date, time, name of test, and source of culture
- Biohazard bag(s)
- Organization-approved disinfectant wipes
- Oxygen therapy equipment, if indicated

For an expectorated specimen:

- PPE (gloves, gown, mask, and eye protection or face shield)
- Emesis basin (optional)
- Facial tissues
- Toothbrush and water (optional)
- Sterile specimen container (sputum trap) with cover

For a suctioned specimen:

- PPE (gloves, sterile gloves, gown, mask, and eye protection or face shield)
- In-line specimen container or sputum trap
- Suction source with vacuum regulator
- Sterile, water-soluble lubricant
- Sterile, appropriate-size sterile suction catheter or an existing sleeved suction catheter

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