

Endotracheal Tube and Tracheostomy Tube Suctioning – CE

ALERT

Suction the patient's artificial airway only as clinically indicated and not as a routine, fixed-schedule treatment.¹ Limit each pass to less than 15 seconds.¹

If the patient develops respiratory distress or cardiac decompensation during the suctioning procedure, immediately withdraw the catheter, supply additional oxygen, and deliver manual breaths as needed.

Suctioning can cause elevations in intracranial pressure (ICP) in patients with head injuries.

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

OVERVIEW

Endotracheal (ET) or tracheostomy tube suctioning is performed to maintain the patency of the artificial airway and prevent complications. The presence of artificial airways impairs effective coughing and secretion removal, which may result in the need for periodic removal of pulmonary secretions with suctioning. In acute-care situations, suctioning is always performed as a sterile procedure to prevent hospital-acquired pneumonia. Suctioning may result in serious complications, such as hypoxemia, arrhythmias, hypertension or hypotension, increased ICP, bronchospasms, trauma to the mucosa, pain, and anxiety. Evidence shows that ICP can take up to 10 minutes to return to baseline levels after suctioning.³ In brain-injured patients, it is recommended to allow 10 minutes between suctioning procedures.³

Suctioning is performed by using one of two basic methods: the closed-suction technique or the open-suction technique.

The closed-suction technique, also referred to as inline suctioning, involves attaching a sterile, closed, inline suction catheter to the ventilator circuit.¹ A multiuse suction catheter inside a sterile plastic sleeve is inserted through a special diaphragm attached to the end of the ET or tracheostomy tube. The closed-suction technique is the preferred method for suctioning because it facilitates continuous mechanical ventilation and oxygenation during the suctioning procedure. The closed-suction technique allows for a continued tidal volume delivery to the patient with minimal loss of lung volume. Closed suctioning is suggested for an adult patient with high fraction of inspired oxygen (FIO₂) or positive end-expiratory pressure (PEEP) or for a patient who is at risk for lung derecruitment.¹ Inline catheters should be changed per the organization's practice.

The open-suction technique requires disconnecting the patient from the ventilator before performing suctioning.³ This technique can cause a significant loss of lung volume, which can further exacerbate lung derecruitment. The ET or tracheostomy tube is removed from the oxygen source, and 100% oxygen is administered to the patient. Sterile technique is encouraged with the

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open-suction technique, using a sterile single-use suction catheter inserted into the artificial airway.

Suctioning should be ceased immediately if the patient develops any adverse effects. Adverse effects of ET suctioning include:

- Hypoxemia
- Pulmonary hemorrhage or bleeding
- Arrhythmias (tachycardia, bradycardia, heart blocks)
- Increased ICP
- Bronchospasm
- Atelectasis
- Mucosal trauma
- Hypertension or hypotension
- Cardiac arrest
- Respiratory arrest

Adequate systemic hydration and supplemental humidification of inspired gases assist with thinning secretions for easier aspiration from airways. Routine instillation of 0.9% sodium chloride solution before ET suctioning is not recommended.¹ Evidence shows an association between instillation of 0.9% sodium chloride solution and ventilator-associated pneumonia (VAP) and hemodynamic changes.²

Administering 100% oxygen pre-suction and post-suction reduces hypoxemia; however, it is not without risks such as absorption atelectasis. Administering 100% oxygen must be considered if the patient has experienced a clinically significant reduction in oxygen saturation with suctioning, has high oxygen and PEEP requirements, or has a compromised cerebral circulation.² A decrease in partial pressure of arterial oxygen (PaO₂) along with an increased partial carbon dioxide pressure (PaCO₂) results in an increase in vasodilation. This vasodilation can then increase cerebral blood flow and consequently elevate ICP and decrease cerebral perfusion pressure (CPP).

For an adult patient, the size of the suction catheter should be one half the inner diameter of the artificial airway, providing a lumen diameter ratio of 0.5.¹ Closed-suction catheters are available in two lengths: one for ET tubes (approximately 56 cm [22 in]), which is sufficient to reach the main stem bronchi, and one for tracheostomy tubes (approximately 30.5 cm [12 in]).⁴ A curved tip or coude catheter is available for selective left main stem bronchial access.⁴

EDUCATION

- Provide developmentally and culturally appropriate education based on the desire for knowledge, readiness to learn, and overall neurologic and psychosocial state.
- Provide the patient and family with an explanation of the equipment and the procedure.
- Explain to the patient and family that suctioning may be uncomfortable, causing temporary shortness of breath or coughing.

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- Explain to the patient how to use nonverbal cues to assist the health care team with understanding what the patient may be experiencing.
- Explain the patient's responsibility to cough during the procedure to assist with secretion removal, if the patient is conscious.
- Ensure that the family understands all the steps if they will be performing suctioning at home. Plan to observe the family's performance of the procedure.
- Encourage questions and answer them as they arise.

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 patient.
3. Verify the correct patient using two identifiers.
4. Assess the patient for signs of airway compromise or inadequate oxygenation.
 - a. Thick secretions in the airway that cannot be cleared with coughing
 - b. Decreased or absent breath sounds
 - c. Adventitious lung sounds (e.g., wheezes, rhonchi, crackles)
 - d. Restlessness or decreased level of consciousness
 - e. Acute respiratory distress
 - f. Tachypnea
 - g. Tachycardia or bradycardia
 - h. Cyanosis or pallor
 - i. Hypertension or hypotension
 - j. Shallow respirations
 - k. Use of accessory muscles
 - l. Decreased oxygen saturation
 - m. Increased peak airway pressure
 - n. Sawtooth pattern on the flow-volume loop on the ventilator monitor⁵

Rationale: A sawtooth pattern on the flow-volume loop on the monitor screen of the ventilator is a strong indicator of retained pulmonary secretions.^{1,5}

Preparation

1. Provide reassurance and support to the patient to demonstrate an understanding of his or her dependence and vulnerability.

Rationale: Patients experience a loss of control over themselves and their situation because of the degree of physical dependence when they are mechanically ventilated.

2. Assist the patient to a comfortable position, generally a semi-Fowler or Fowler position.

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3. Enlist additional staff to assist with the procedure as needed.
4. Determine the appropriate depth to advance the suction catheter.
5. Test the suction device at the beginning of the shift and upon suction setup to ensure that it is operational.
6. Identify the proper size of suction catheter to use by first multiply the tube's inner diameter by 2 and then selecting the next smallest size catheter.⁴

PROCEDURE

Closed-Suction Technique

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 patient using two identifiers.
3. Explain the procedure to the patient and ensure that he or she agrees to treatment.
4. Turn the suction apparatus on. Adjust the vacuum regulator to less than 150 mm Hg.¹

Use only the amount of suction necessary to remove secretions effectively. High negative-pressure settings may increase tracheal mucosal damage.¹

5. Check the negative pressure of the suction apparatus by occluding the end of the suction tubing before attaching it to the suction catheter.
6. Connect the suction tubing to the suction port or unlock the thumb valve, according to the manufacturer's instructions.
7. Consider administering 100% oxygen for 30 to 60 seconds before suctioning using one of these methods:¹
 - a. With the nondominant hand, increase the baseline FiO_2 level to 100% on the mechanical ventilator.¹
 - b. With the nondominant hand, press the appropriate button on the ventilator to deliver 100% oxygen.

Administer 100% oxygen to prevent a decrease in oxygen saturation during the suctioning procedure.¹

Manual ventilation is not recommended. If used, it is essential that PEEP be maintained.¹

8. With the dominant hand, gently but quickly insert the catheter into the artificial airway with the control vent of the suction catheter open.
 - a. In patients at high risk for suction-related complications, insert the catheter into the artificial airway until it emerges out of the end of the airway.²
 - b. In patients not at risk for suction-related complications, insert the catheter into the artificial airway until resistance is met and then pull it back 1 to 2 cm.²

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9. Using the dominant thumb, depress the control vent of the suction catheter to apply continuous suction while completely withdrawing the catheter into the sterile catheter sleeve within 15 seconds.¹ Using the nondominant thumb and forefinger, stabilize the airway while withdrawing the catheter.

Ensure that each suction pass lasts less than 15 seconds to minimize decreases in oxygen saturation.¹ Do not instill 0.9% sodium chloride solution before suctioning.¹

10. Perform an additional pass of the suction catheter if secretions remain in the airway and the patient is tolerating the procedure. Two to four suctioning passes may be needed to clear secretions.⁵

Rationale: The number of suction passes should be based on the amount of secretions and the patient's clinical assessment.

Do not exceed two to four passes per suctioning procedure in order to minimize oxygen desaturation and cardiopulmonary complications.^{1,5}

- a. Allow adequate time between passes for the patient to recover before the next pass. Consider administering 1 minute of 100% oxygen after each pass of the suction catheter.⁴
- b. Consider administering 100% oxygen for 30 to 60 seconds after suctioning.¹
- c. Monitor the patient for adverse reactions.
- d. Return FIO₂ to the baseline level after suctioning is complete.

Allow an interval of 10 minutes between any method of suctioning in a brain-injured patient to decrease the risk of elevating ICP.³

11. Perform oropharyngeal suctioning using a Yankauer suction catheter after the lower airway has been adequately cleared of secretions.

Rationale: Suctioning the oropharyngeal area if secretions are present may enhance the patient's comfort and is part of an oral hygiene program.

Take care to avoid causing oropharyngeal tissue trauma and gagging during suctioning.

12. Rinse the catheter and connecting tubing with sterile 0.9% sodium chloride solution or sterile water until clear.
 - a. Align the suction port of the catheter with the side port.

Rationale: Aligning the suction port of the catheter with the side port locks the system so the catheter cannot inadvertently migrate down the ET tube.

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- b. Apply continuous suction and simultaneously instill sterile 0.9% sodium chloride solution or sterile water into the side port of the inline catheter with a syringe or saline aliquot (i.e., saline bullet).

Do not lavage the fluid down the ET tube.

- c. Repeat until the catheter is clear.

Rationale: Repeating removes buildup of secretions in the connecting tubing and the inline suction catheter.

13. Turn the suction device off and lock the thumb control.

Rationale: Locking the thumb control valve prevents accidental depression when not in use.

14. Ensure that the FiO_2 is returned to the baseline level.
15. Assess the volume, consistency, and color of the airway secretions.

Notify the practitioner of changes in the airway secretions, which could be a sign that the patient is developing pneumonia or other adverse effects.

16. Maintain the suction collection tubing and canisters for subsequent suctioning episodes. Follow the organization's practice for discarding and removing multiuse sterile solution containers and equipment.
17. Discard supplies, remove PPE, and perform hand hygiene.
18. Document the procedure in the patient's record.

Open-Suction Technique

1. Perform hand hygiene and don gloves and appropriate PPE based on the patient's signs and symptoms and indications for isolation precautions. Don gown, mask, and eye protection or face shield if the risk of splashing exists.
2. Verify the correct patient using two identifiers.
3. Explain the procedure to the patient and ensure that he or she agrees to treatment.
4. Turn the suction apparatus on and set the vacuum regulator to less than 150 mm Hg.¹

Use only the amount of suction necessary to remove secretions effectively. High negative-pressure settings may increase tracheal mucosal damage.¹

5. Check the negative pressure of the suction apparatus by occluding the end of the suction tubing before attaching it to the suction catheter.
6. Using aseptic technique, open the sterile catheter package on a clean surface, using the inside of the wrapping as a sterile field; open the package just enough to expose the connecting end and connect the catheter to the suction tubing.

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Rationale: Catheters and solutions that come in direct contact with the lower airways during suctioning must be sterile to decrease the risk of hospital-acquired pneumonia.

7. Obtain sterile 0.9% sodium chloride solution or sterile water to irrigate the suction catheter.
8. Remove gloves, perform hand hygiene, and don sterile gloves.
9. With the dominant hand, pick up the suction catheter, taking care to avoid touching any nonsterile surfaces. With the nondominant hand, pick up the connecting tubing. Connect the suction catheter to the connecting tubing.

Ensure that the dominant hand does not come in contact with the connecting tubing. Wrap the suction catheter around the sterile dominant hand to help prevent inadvertent contamination of the catheter.

10. Check the equipment for proper functioning by suctioning a small amount of sterile solution from the container.
11. Consider administering 100% oxygen for 30 to 60 seconds before suctioning using one of these methods:¹
 - a. With the nondominant hand, increase the baseline FiO₂ level to 100% on the mechanical ventilator.¹
 - b. With the nondominant hand, press the appropriate button on the ventilator to deliver 100% oxygen.

Administer 100% oxygen before suctioning to prevent a decrease in oxygen saturation during the suctioning procedure.¹

Manual ventilation is not recommended. If used, it is essential that PEEP be maintained.¹

12. With the dominant hand, gently but quickly insert the catheter into the artificial airway with the control vent of the suction catheter open.
 - a. In patients at high risk for suction-related complications, insert the catheter into the artificial airway until it emerges out of the end of the airway.²
 - b. In patients not at risk for suction-related complications, insert the catheter into the artificial airway until resistance is met and then pull it back 1 to 2 cm.²

Ensure that each suction pass lasts less than 15 seconds to minimize decreases in oxygen saturation.¹ Do not instill 0.9% sodium chloride solution routinely before suctioning.¹

13. Using the nondominant thumb, depress the control vent of the suction catheter to apply continuous suction while completely withdrawing the catheter into the sterile catheter sleeve within 10 to 15 seconds.¹

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14. Perform an additional pass of the suction catheter if secretions remain in the airway and the patient is tolerating the procedure. Two to four suctioning passes may be needed to clear secretions.⁵

Rationale: The number of suction passes should be based on the amount of secretions and the patient's clinical assessment.

Do not exceed two to four passes per suctioning procedure to minimize oxygen desaturation and cardiopulmonary complications.^{1,5}

- a. Allow adequate time between passes for the patient to recover before the next pass. Consider administering 1 minute of 100% oxygen after each pass of the suction catheter.⁴
- b. Consider administering 100% oxygen for 30 to 60 seconds after suctioning.¹
- c. Monitor the patient for adverse reactions.
- d. Return FIO₂ to the baseline level after suctioning is complete.

Leave an interval of 10 minutes between any method of suctioning in a brain-injured patient to decrease the risk of elevating ICP.³

15. If the patient does not tolerate open suctioning despite administering 100% oxygen:

- a. Ensure that FIO₂ is set at 100%.¹
- b. Maintain PEEP during suctioning.
- c. Allow longer recovery intervals between suction passes.
- d. If the patient does not tolerate open suctioning after these steps, switch to a closed-suction technique.

16. Perform oropharyngeal suctioning using the same suction catheter or a Yankauer suction catheter after the lower airway has been adequately cleared of secretions.

Rationale: Suctioning of the oropharyngeal area if secretions are present may enhance the patient's comfort and is part of an oral hygiene program.

Take care to avoid causing oropharyngeal tissue trauma and gagging during suctioning. Do not use the catheter to suction the lower airways again following oropharyngeal suctioning because the catheter is contaminated with bacteria present in the oral cavity.

17. Rinse the catheter and connecting tubing with sterile 0.9% sodium chloride solution or sterile water until clear. Suction unused solution until the tubing is clear.

Rationale: Suctioning of unused solution removes buildup of secretions in the connecting tubing.

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18. Wrap the catheter around the dominant hand after the upper airway suctioning is complete.
Pull the glove off inside out; the catheter remains in the glove. Pull the other glove off in the same manner and discard.
19. Turn the suction device off.
20. Ensure that the FIO₂ is returned to the baseline level.
21. Assess the volume, consistency, and color of the airway secretions.

Notify the practitioner of changes in the airway secretions, which could be a sign that the patient is developing pneumonia or adverse effects.

22. Maintain the suction collection tubing and canisters for subsequent suctioning episodes.
Follow the organization's practice for discarding and removing multiuse sterile solution containers and equipment.
23. Discard supplies, remove PPE, and perform hand hygiene.
24. Document the procedure in the patient's record.

MONITORING AND CARE

1. Ensure that ventilator and oxygen settings are as ordered.
2. Monitor the patient's cardiopulmonary status during and after the suctioning period.

Reportable conditions: Decreased oxygenation, cardiac arrhythmias, bronchospasm, respiratory distress, cyanosis, increased blood pressure or ICP, anxiety, agitation, pain, changes in mental status

3. Reassess the patient for signs of suctioning effectiveness. If the patient is able to verbalize, ask whether breathing is easier and congestion is decreased. Breath sounds may not improve after suctioning; therefore, assessment of lung sounds may not be a reliable method for detecting a need for suctioning.⁵

Rationale: Asking the patient whether breathing is easier and congestion is decreased provides subjective confirmation that the suctioning procedure has relieved airway compromise.

Reportable conditions: Diminished or absent breath sounds, decreased oxygenation, increased peak airway pressure, coughing, increased work of breathing, increased ICP

4. Assess, treat, and reassess pain.

EXPECTED OUTCOMES

- Removal of secretions from the airway
- Improved gas exchange
- Airway patency
- Amelioration of clinical signs or symptoms that indicated need for suctioning (e.g., adventitious breath sounds, coughing, high airway pressure)

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UNEXPECTED OUTCOMES

- Cardiac arrhythmias
- Increased ICP or changes in CPP
- Hypoxemia
- Bronchospasm
- Atelectasis
- Mucosal trauma
- Hypertension or hypotension
- Ventilator-associated pneumonia
- Blood in sputum
- Inability to pass the suction catheter

DOCUMENTATION

- Education
- Patient's tolerance of the procedure
- Respiratory assessment, including clinical indication for suctioning
- Administration of 100% oxygen if used
- Number of passes of the suction catheter
- Volume, color, and consistency of secretions obtained
- Unexpected outcomes and related interventions
- Pain assessment and management

REFERENCES

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*In these skills, a “classic” reference is a widely cited, standard work of established excellence that significantly affects current practice and may also represent the foundational research for practice.

AACN Levels of Evidence

- Level A - Meta-analysis of quantitative studies or metanalysis of qualitative studies with results that consistently support a specific action, intervention, or treatment
- Level B - Well-designed, controlled studies, with results that consistently support a specific action, intervention, or treatment
- Level C - Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results
- Level D - Peer-reviewed professional organizational standards with clinical studies to support recommendations
- Level E - Multiple case reports, theory-based evidence from expert opinions, or peer-reviewed professional organizational standards without clinical studies to support recommendations
- Level M - Manufacturer's recommendations only

SUPPLIES

Closed-Suction Technique:

- Gloves and PPE as indicated
- Closed-suction setup with a catheter of appropriate size
- Source of suction (wall mounted or portable) with connecting tubing
- Yankauer suction catheter
- Sterile single-use 0.9% sodium chloride solution lavage containers

Open-Suction Technique:

- Gloves, sterile gloves and PPE as indicated
- Sterile suction catheter of appropriate size
- Sterile 0.9% sodium chloride solution or sterile water
- Source of suction (wall mounted or portable) with connecting tubing
- Sterile solution container
- Yankauer suction catheter
- MRB connected to an oxygen flowmeter with a PEEP valve, if needed

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