Comparing Suction Techniques: Protecting You & Your Patients

A presentation for HealthTrust members
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Speaker Disclosures

- The presenter serves as an Assistant Professor of Respiratory Therapy at the University of Alabama Birmingham.

- This program may contain the mention of drugs or brands presented in a case study or comparative format using evidence-based research. Such examples are intended for educational and informational purposes and should not be perceived as an endorsement of any particular supplier, brand or drug.

Learner Objectives

- Identify two patient conditions where closed suction is preferred over open suction
- Explain two key factors in the cost analysis of closed suction vs. open suction
- Describe the limitations and advantages of open suction

Endotracheal Tube Suction

- Most common invasive ICU procedure
- Enhances respiratory tract secretion clearance
- Improves oxygenation
- Improves ventilation
- Ensures airway patency

Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

Closed Suction

- Inline sterile suction catheter
- Single patient/multiple use sterile catheter
- Does NOT require disconnection from ventilator circuit

Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

Open Suction

- Sterile technique
- Single use catheter
- Requires disconnection from the ventilator circuit

Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

Indications for ETT Suctioning

- The need to maintain the patency and integrity of the artificial airway
- The removal of retained pulmonary secretions
- The need to obtain a sputum specimen

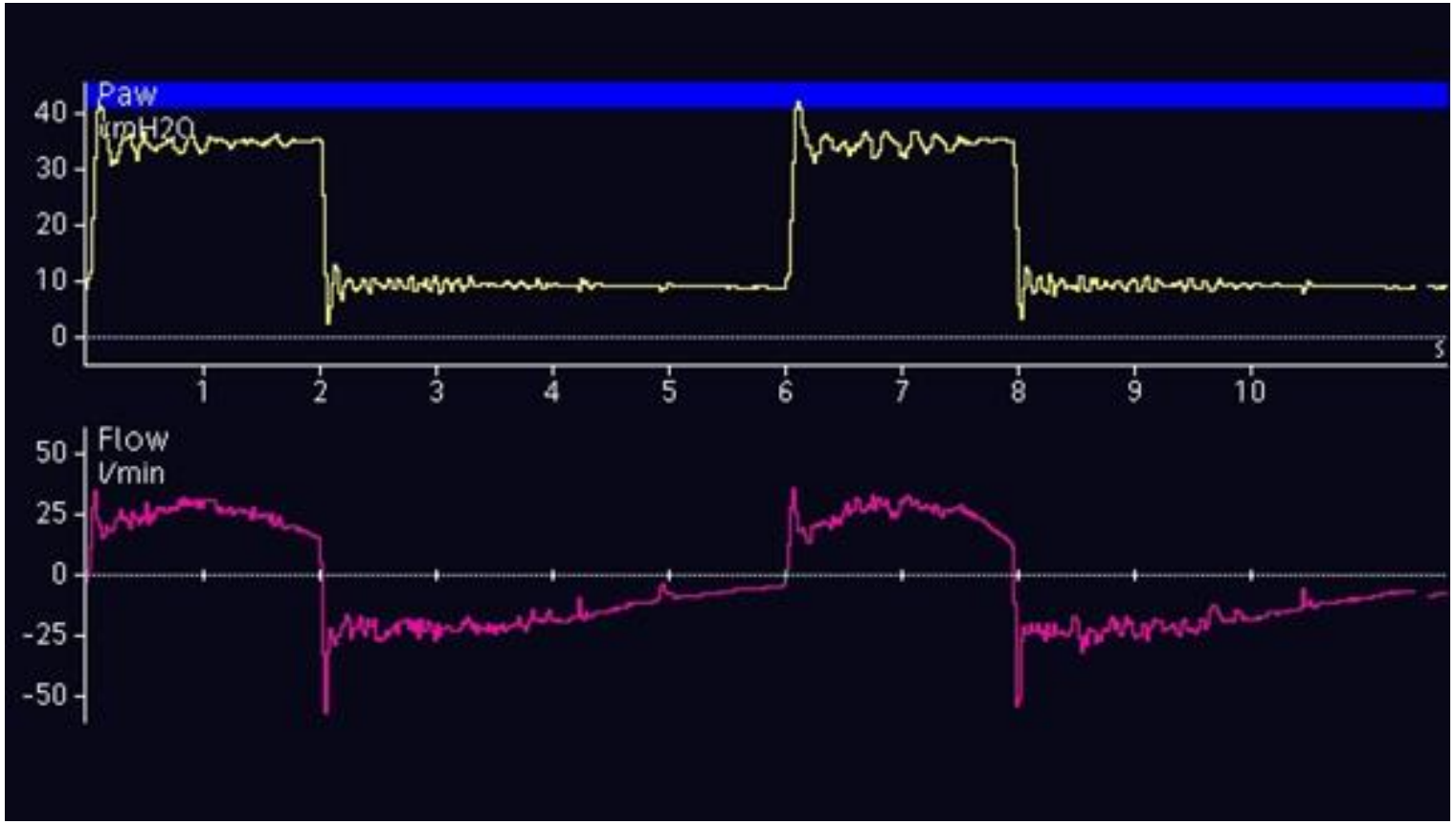
Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

Signs of Retained Secretions

- Saw tooth pattern on flow or flow/time wave form
- Course Crackles
- Increased Peak Inspiratory Pressures (only during Volume Control ventilation)
- Decreased Vt (Tidal Volumes)- (only during Pressure Control ventilation)
- Decreased Oxygenation (SpO2 or PaO2)
- Visible secretions in the ETT
- Acute Respiratory Distress

Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

Retained Secretions



Indications for ETT suctioning include all of the following EXCEPT?

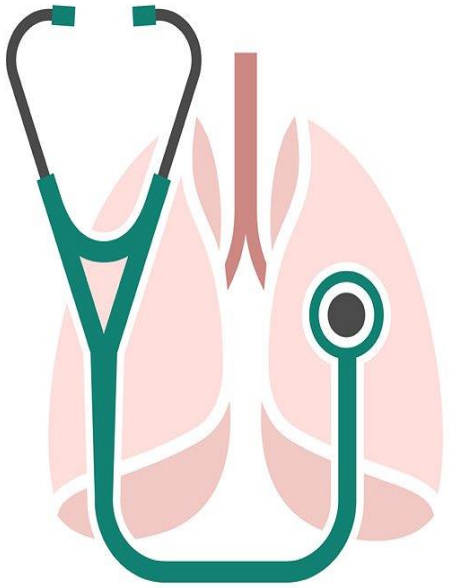
- A. Sawtooth pattern on a flow waveform
- B. Increased Plateau Pressures
- C. Increased Peak Inspiratory Pressures
- D. Coarse crackles (Rhonchi) breath sounds

Indications for ETT suctioning include all of the following EXCEPT?

- B. Increased Plateau Pressures

Patient Assessment

- Bilateral breath sounds
- Vital signs- HR, RR, SpO2, and BP
- ETT location
- Ventilator settings (PEEP, FiO2)
- Ventilator parameters (VE, Vt, PIP, Waveforms)
- Secretion amount, color and viscosity



Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

ETT Suctioning Recommendations

- ETT suctioning should only be performed PRN
- Shallow suctioning instead of deep suctioning
  - Shallow- the length of the artificial airway plus the adapter
  - Deep- insertion until resistance is met, with 1 cm withdrawal
- No routine use of Normal Saline

Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

ETT Suctioning Recommendations

- Pre-Oxygenation
- Suction catheter size- <50 % ID ETT (adults), <70 % (infants)
- Application of negative pressure limited to 15 seconds
- Recommended negative pressure-

  Neonates 80-100 mmHg

  Adults <150 mmHg

- ID x 3 / 2 = Catheter size

Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

ETT Suctioning Recommendations

- Perform suctioning without disconnection of ventilator circuit
- Use closed suction with high FiO2, PEEP to prevent lung derecruitment
- Closed system use with neonates

Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

Endotracheal suctioning should be performed?

- A. On a scheduled basis (Q4hours)
- B. On a PRN (as needed) basis
- C. Only before extubation
- D. When the patient requests it

Endotracheal suctioning should be performed?

- B. On a PRN (as needed) basis

Open Suction Technique

- Single use procedure
- Sterile technique required
  - Increase risk of cross contamination
- Hyperoxygenation and hyperventilation require extra tools
- Loss of PEEP
- Requires disconnection from ventilator circuit
  - Loss of PEEP
  - Loss of Oxygentation

Source: Kacmarek, R. (Ed) et. al. (20047) Egan's Fundamentals of Respiratory Care. St. Louis, Mo: Elsevier. 11th ed

Open Suction Equipment

- Vacuum source
- Sterile flexible catheter
- Non-sterile gloves
- Goggles/mask
- Sterile gloves

Source: Kacmarek, R. (Ed) et. al. (20047) Egan's Fundamentals of Respiratory Care. St. Louis, Mo: Elsevier. 11th ed

Open Suction Equipment

- Sterile water cup
- Sterile water/normal saline
- Oxygen source
- Extra personnel (recommended, but not required)

Source: Kacmarek, R. (Ed) et. al. (20047) Egan's Fundamentals of Respiratory Care. St. Louis, Mo: Elsevier. 11th ed

Closed Suction Technique

- Multi-use procedure
- Clean technique required
- Hyperventilation and Oxygenation with mechanical ventilator
- Ventilator circuit remains intact
  - Maintain PEEP
  - Maintain ventilation
  - Maintain FiO2

Source: AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways 2010. Respiratory Care. 2010, Jun; (758-64)

Closed Suction Equipment

- Sterile multi-use catheter
- Clean exam gloves
- Normal saline (to flush/clean catheter)
- Mechanical ventilator for hyperoxygenation

Source: Kacmarek, R. (Ed) et. al. (20047) Egan's Fundamentals of Respiratory Care. St. Louis, Mo: Elsevier. 11th ed

Equipment Comparison

Both Open & Closed Suctioning	Open Suctioning	Closed Suctioning
Vacuum source	Sterile, flexible open suction catheter*	Sterile, multi-use closed suction catheter
Calibrated, adjustable regulator	Sterile disposable gloves	Clean disposable exam gloves
Collection bottle and connecting tubes	Sterile water/normal saline and cup if needed to clear catheter*	Sterile water/normal saline to flush/clean catheter, or vials of saline for in-line placement
Goggles/mask and other appropriate equipment for standard precautions	Oxygen source with a calibrated flow meter	Mechanical ventilator for hyperoxygenation
Pulse oximeter		
Manual Resuscitation bag equipped with oxygen-enrichment device, and PEEP valve (for emergency use)		
Stethoscope		
Electrocardiograph (optional)		
Sterile sputum trap for culture specimen (optional)		
*The catheter, gloves, and cup required for open suctioning are often packaged in a disposable sterile kit.		
Source: Altobelli N. Airway management. In: Kacmarek RM, Stoller JK, Heuer AJ, eds. Egan's Fundamentals of Respiratory Care. 11th ed. St. Louis, MO: Mosby; 2016:739-789.		

Cochrane Review

- Literature review
- 16 trials closed or open suction systems adult patients who were ventilated for more than 24 hours

Source: Subirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews.* 2007(4):Cd004581.

Research Limitations

- Difficult to research
- Methodology quality of all the studies
  - Difficult to define and compare similar patient groups (70 yowm with CHF to 70 yowm with COPD)
- Inaccuracy in reporting information relating to randomization methods

Source: Subirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews.* 2007(4):Cd004581.

Suggested Advantages of CSS

- Improved Oxygenation
- Maintain PEEP
- Limited environmental exposure
- Decreased clinical signs of hypoxemia
- Limited personnel and patient contamination
- Smaller lung volume loss

Souroce: Subirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews*. 2007(4):Cd004581.

Advantages of closed suction over open suction include all of the following except?

- A. Maintains PEEP and Oxygenation
- B. Faster and easier to perform
- C. Prevents cross contamination and minimizes infection risk
- D. Both require the use of sterile gloves

Advantages of closed suction over open suction include all of the following except?

- D. Both require the use of sterile gloves

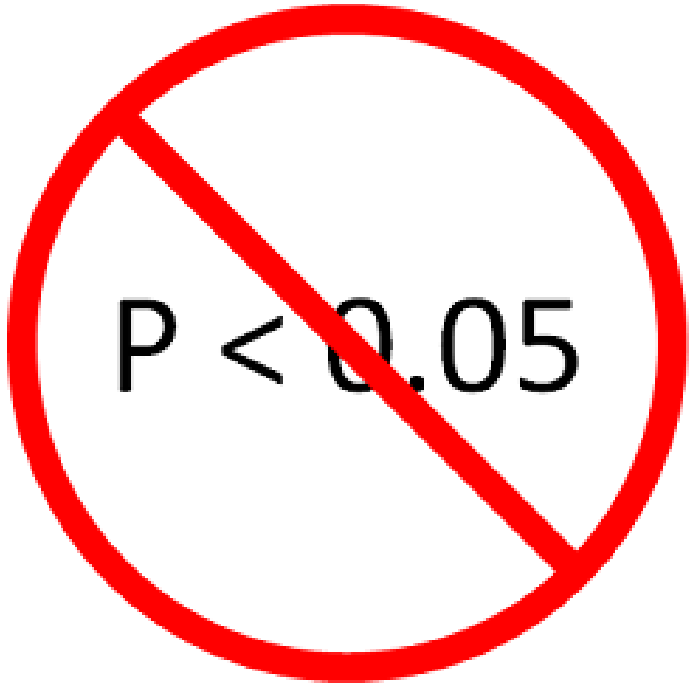
CS vs. OS Research Outcomes

- No statistical difference for
  - VAP (VAP was used when the research project was performed.)
  - Mortality
  - Time on ventilation (4 studies showed highly skewed data)
  - Length of stay (2 studies reported skewed data)

Source: Subirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews.* 2007(4):Cd004581.

CS vs. OS Research Outcomes

- No statistical difference for
  - Quantity of secretions
  - Respiratory rate (unclear if patients were sedated or modes of ventilation)
  - Oxygenation for patients with PEEP <10 cm H2O



Ssource: ubirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews.* 2007(4):Cd004581.

CS vs. OS Research Outcomes

- CS showed significant increase in colonization
- CS costs were much higher in 4/5 studies
  - Lower cost with CS in patients ventilated for more than four days
- OS groups significant decrease in oxygen saturation immediately after the suction procedure

Source: Subirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews.* 2007(4):Cd004581.

CS vs. OS Research Outcomes

- CS groups maintained or increased their oxygen saturation
- OS groups marked decrease in airway pressure during suction (PEEP)
- CS groups minor decrease in airway pressure during suction (PEEP)

Source: Subirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews.* 2007(4):Cd004581.

CS vs. OS Research Outcomes

- CS avg time of procedure = 2.5 minutes
- OS avg time of procedure = 3.5 minutes

- Conflicting reports regarding
  - Heart Rate
  - Dysrhythmias

Source: Subirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews.* 2007(4):Cd004581.

Costs Analysis

- Should be performed by the RT/Nursing Leadership
- Configure cost per suction event
- *Difficult to study with all the possible variables in cost

Advantages of CS

- Easier and quicker to perform
- Reduces environmental and hospital staff exposure to contaminated aerosols
- Maintain ventilator parameters
- Prevention of lung volume loss/alveolar derecruitment

Advantages of OS

- Cheaper (initially)

Source: Subirana M, Sola I, Benito S. Closed tracheal suction systems versus open tracheal suction systems for mechanically ventilated adult patients. *The Cochrane database of systematic reviews.* 2007(4):Cd004581.

CS and Infection Control

- Original designed with 24 hour catheter change
- New Quality Improvement research suggested weekly (or PRN for soilage) with no risk of increasing VAP

*Discuss with QI and manufacturer representative

*Follow your facility's infection control policy and department protocols

Source:Stoller, J, MD. et al. "Weekly vs. Daily Changes of In-Line Suction Catheters: Impact on Rates of VAP and Associated Costs". Respiratory Care; May 2003.

Open-sterile ETT suctioning is?

- A. Always cheaper than closed suctioning
- B. Always more expensive than closed suctioning
- C. Cost the same as closed suctioning
- D. Cost dependent on the number of suction catheters used

Open-sterile ETT suctioning is?

- D. Cost dependent on the number of suction catheters used

CDC Recommendations

Breathing circuits with humidifiers

- Do not change routinely, on the basis of duration of use, the breathing circuit (i.e., ventilator tubing and exhalation valve and the attached humidifier) that is in use on an individual patient. Change the circuit when it is visibly soiled or mechanically malfunctioning

Source: https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm

Summary

- Multiple studies with conflicting results

- Confirmed data
  - CS is recommended with high level PEEP and FiO2
  - No significant statistical difference in hemodynamic and respiratory stable patients
  - Cost analysis dependent on total number of ETT suction events

Thank you!

Thank you for attending this continuing education presentation.

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