

Educational Tools

Enhancing the Safety of Medical Suction Through Innovative Technology

Patricia Carroll, RN, BC, CEN, RRT, MS

Abstract: Medical suctioning is essential for patient care. However, few clinicians receive training on the principles of physics that govern the safe use of medical suction. While all eight manufacturers of vacuum regulators sold in North America require a minimum of 100 mmHg, the amount of negative pressure (vacuum) is not aware of this requirement or skip this step when prepared for use. This white paper summarizes the physics relating to medical suction, the consequences of damaged mucosa, the risks to patient safety when suction levels are not properly set and regulated, and technology advances that enhance patient safety.

Medical suction is an essential part of clinical practice. Since the 1920s, it has been used to empty the stomach, and in the 1950s, airway suction levels were first regulated for safety. Today, medical suction is used for newly born babies and adults, and in patients weighing between 100 grams and 500 pounds. Medical suction clears the airway, empties the stomach, decompresses the chest, and helps the operative field clear. It is essential that clinicians have reliable equipment that is accurate and easy to use.

Why a Safety Mindset is Important

The current focus on patient safety extends to suction procedures and practices. When suction pressures are too high, mucosal damage occurs, both in the airway and in the stomach. If much negative pressure is applied through a chest tube, lung tissue can be drawn into the cyclone of the thoracic catheter. Researchers are examining the connection between airway mucosal damage and ventilator-associated pneumonia. In pediatrics, airway suction catheters are inserted to a pre-measured length that avoids being the suction catheter come in contact with the tracheal mucosa distal to the endotracheal tube. Mucosal damage can also be mitigated with appropriate suction techniques, and every effort should be made to reduce this risk to the minimum system of patients who are already compromised. Damaged airway mucosa releases irritants that support bacterial growth, and P. aeruginosa and other organisms are drawn to damaged epithelium. Mucosal damage in the stomach can result in bleeding and necrosis as well as formation of ulcers.

Physics of Suction

Flow rate is the term used to describe how fast air, fluid, or

Vacuum regulators are over-present in the hospital setting. Clinicians use them daily and may not be as attentive to this

Reference Neonatal Intensive Care, May-June 2008 Issue, Article: Enhancing the safety of Medical Suction Through Innovative Technology, by Patricia Carroll, RN, BC, CEN, RRT, MS

Avoiding the Hazards of Inadvertent Administration of High Suction Pressures

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Video 1: Clinical Animation Video
"Avoiding the Hazards of Inadvertent Administration of High Suction Pressures"

Video 2: Clinical Video
"Understanding the Hazards of Tracheal Oversuctioning"

The Principles of Vacuum And Clinical Application in the Hospital Environment

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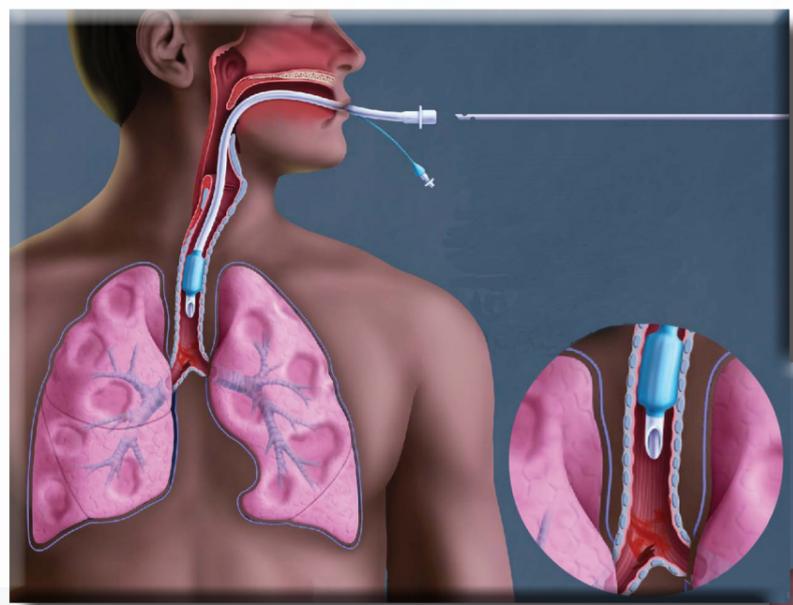
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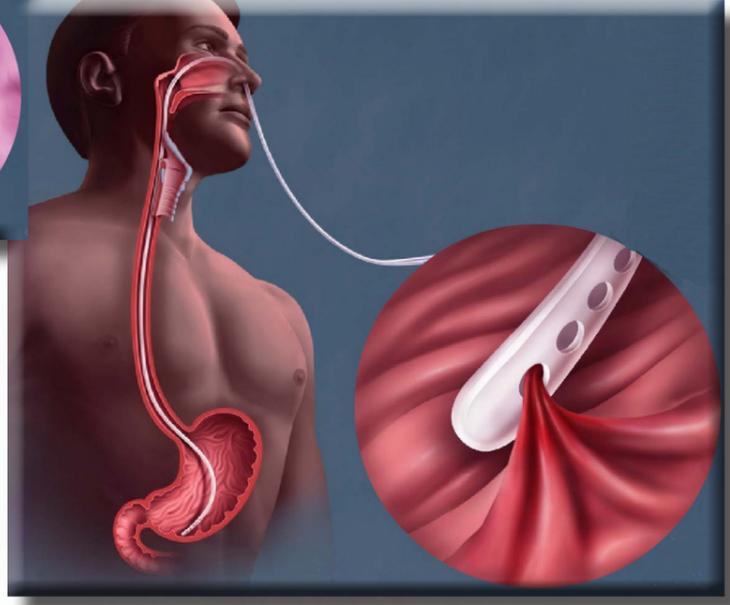
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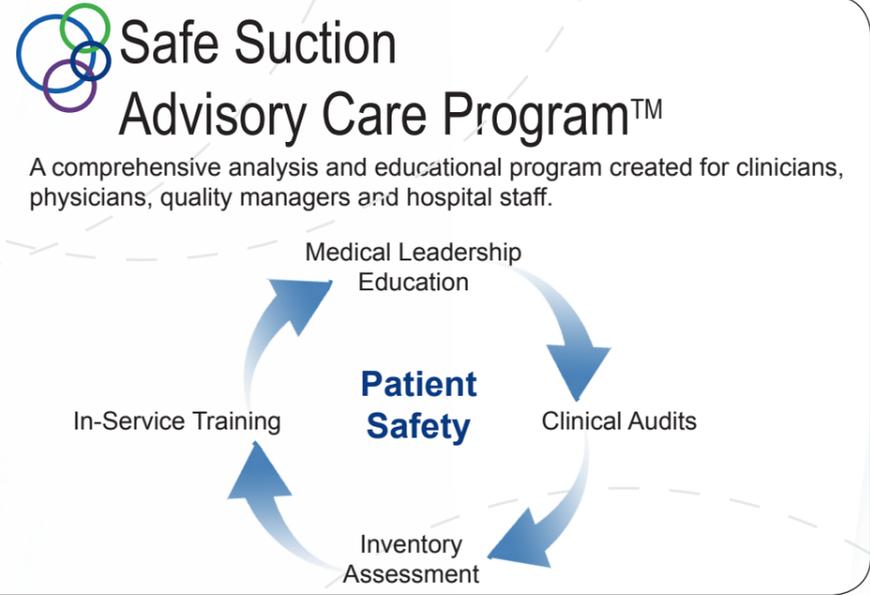


Tracheal



Nasogastric

Avoiding the Hazards of Inadvertent Administration of High Suction Pressures



Reference Information

1. Excerpt from American Association of Respiratory Care® 2010 published Guidelines Endotracheal Suctioning of Mechanically Ventilated Patients with Artificial Airways; Section 2.3
2. Smeltzer, Suzanne, Brenda Bare, Janice Hinkle, and Kerry Cheever. Brunner and Suddarth's Textbook of Medical-Surgical Nursing: 12th edition (2009), page 1022.
3. Prevention of Endotracheal Suctioning-induced Alveolar De-recruitment in Acute Lung Injury; Salvatore M. Maggiore, Francois Lellouche, Jerome Pigeot, Solenne Taille, Nicolas Deye, Xavier Durrmeyer, Jean-Christophe Richard, Jordi Mancebo, Francois Lemaire, Laurent Brochard. Published in Feb. 2003 American Journal of Respiratory and Critical Care Medicine.

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There are **two** most commonly overlooked **key aspects** of clinical suctioning that could lead to over-suctioning and various clinical complications:

1 Choosing the appropriate suction pressure:

Recommended Guidelines for setting Suction Pressures

Endotracheal [1]*

Adults <150 mmHg
 Infants -60 to -80 mmHg

Nasogastric drainage [2]*

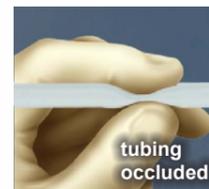
Adult: -30 to -40 mmHg (Intermittent)

Always follow your institution's recommended guidelines for clinical suctioning.

2 Setting the suction pressure correctly:

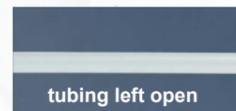
Always Occlude-To-Set for proper suction levels

The negative pressure must be checked by occluding the end of the suction tubing before attaching it to the suction catheter, and prior to each suctioning event[2]*



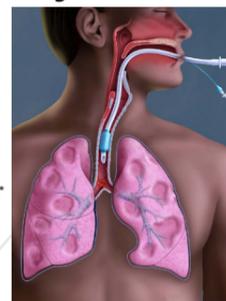
If not occluded . . . and/or not properly set . . .

If the flow path is not occluded, the pressure setting may be as high as -635 mmHg.



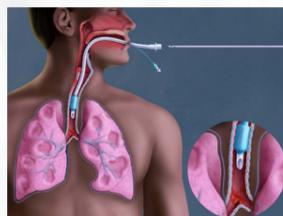
When this happens the clinician inadvertently sets the minimum vacuum pressure. This may expose the patient to high suction pressure that may cause suction-induced lung de-recruitment associated with acute lung injury and Acute Respiratory Distress Syndrome (ARDS) patients.[3]*

Suction-induced Lung De-recruitment



The results could be . . .

inadvertent high suction pressures.
Hazards during suctioning are as follows:



During tracheal suctioning:

- Hypoxia/Hypoxemia [1]*
- Atelectasis [1]*
- Mucosal tissue tears [1]*
- Bleeding [1]*
- Increased risk of infection [1]*

During nasogastric suctioning:

- Mucosal tissue tears [2]*
- Bleeding [2]*
- Increased risk of infection [2]*



*See back cover for reference information

Are your **Vacuum Regulators** helping you to avoid over suctioning your patients?

OHIO MEDICAL'S Push-To-Set™ Technology is an integrated passive safety system designed to prevent inadvertent over-suctioning.



One Simple, One Handed Step

THE TECHNOLOGY:

When the vacuum adjustment knob is depressed, the vacuum flow path is "automatically occluded" and will accurately reflect maximum suction pressure.

Because the patented PTS technology occludes the flow path when the knob is depressed, the clinician is not required to occlude the flow path to set maximum pressure.

DID YOU KNOW.....



- ✓ Push-To-Set™ technology enhances setting safe suction pressures through automatic occlusion.
- ✓ Digital technology enhances display of accurate suction pressure (± 1%) providing unsurpassed safety.