Does the use of a closed suction system help to prevent ventilator-associated pneumonia (VAP)?

Maureen A. Seckel, RN, APN, APRN,BC, CCNS, CCRN, replies:

Tracheal suctioning is an essential component of airway management for patients requiring mechanical ventilation and it is one of the most common invasive procedures performed in any critical care unit today. The primary goals of the suctioning procedure are secretion removal in order to maintain airway patency, decrease airway resistance, achieve optimal oxygenation, and reduce infection risk. Complications of tracheal suctioning include respiratory and cardiac arrest, hemodynamic instability, hypoxia, increased intracranial pressure, bronchospasm, hemorrhage, and tracheal damage.

Currently there are 2 distinct methods available: open system suctioning (OSS) and closed-system suctioning (CSS), or “inline,” suctioning. OSS requires disconnecting the patient from the ventilator and introducing a single-use sterile suction catheter into the tracheal tube. Each suctioning procedure requires the caregiver to use personal protective equipment including masks, goggles or eye shields, and sterile gloves.

In the 1980s CSS became available and this method is the preferred procedure in nearly 60% of critical care units in the United States today. CSS requires a single patient multiuse catheter enclosed in a sterile sleeve, which is advanced through a diaphragm into the trachea. The caregiver wears gloves but is not in direct contact with the patient’s secretions or the catheter. Additionally, because it is not necessary to disconnect from the ventilator circuit, the patient is able to maintain positive end-expiratory pressure (PEEP) and lung volume.

Airway Patency

Several early studies have demonstrated that OSS and CSS are equally effective in secretion removal. With CSS, there is a perception to the caregiver of less effective suctioning due to the muffled suctioning sound and “feel” of the procedure through the plastic sleeve. Decreased sputum visibility in the inline catheter and sleeve may also contribute. The correct suction catheter size and length, along with the correct suction pressure level for both techniques are important considerations to maintain airway patency and the effectiveness of the procedure.

Achieve Optimal Oxygenation

Hyperoxygenation or the delivery of oxygen greater than what the patient is receiving, usually 100% fraction of inspired oxygen before and after suctioning, has been shown to reduce suction-induced hypoxia. Both OSS and CSS can incorporate hyperoxygenation before and after suctioning. However, disconnecting the patient from the ventilator with OSS has been shown to cause a drop in airway pressure, loss of lung volume, and decreased oxygen saturation. With the ability to maintain connection to the ventilator circuit in CSS, patients are continuously receiving mechanical ventilation, PEEP is maintained, and loss of lung volume with associated derecruitment is avoided.

Decreased Infection Risk

A complication of endotracheal intubation and mechanical ventilation, VAP has significant morbidity and mortality. Mirroring VAP prevention recommendations for ventilator circuit changes, guidelines for inline suction catheters include changing these catheters on an
as-needed basis when they are visibly soiled or malfunctioning.17,19 Manufacturer recommendations have included changing the inline catheter every 24 hours. Despite known increased inline catheter bacterial colonization, prolonged catheter use does not appear to increase the incidence of VAP.2,25 However, several studies,20,26 including meta-analysis investigations, conclude that the use of either OSS or CSS has no effect on the incidence of VAP. There are several known advantages to be superior to OSS for VAP prevention. Although CSS does not appear to achieve the primary goals of maintenance airway patency and oxygenation, there are several known advantages of CSS, including the following:

- maintenance of PEEP and oxygenation
- decreased exposure of caregivers
- decreased environmental exposure and prevention of cross-contamination between patients

Review your unit and hospital policy and procedure. Because suctioning is a collaborative practice between respiratory therapy and nursing in most institutions, policies related to suctioning and airway management should be a comprehensive strategy between both departments.

Two additional important considerations for the use of CSS include decreased environmental exposure and risk of bacterial transmission for the patient; in addition, CSS is superior over OSS in decreasing repeated caregiver exposure to the “spray” of infectious secretions during suctioning. Care must be given to maintain the ventilator circuit, prevent accidental disconnects, and adhere to hand washing and infection control policies.

Costs

Inline suction catheters should be considered part of the ventilator circuit and should be changed on an as-needed basis. Despite the increased costs of CSS, savings can be achieved by eliminating routine or daily changes.

Summary

Both OSS and CSS can be used to effectively remove secretions and achieve the primary goals of maintaining airway patency and oxygenation. Although CSS does not appear to be superior to OSS for VAP prevention, there are several known advantages of CSS, including the following:

- maintenance of PEEP and oxygenation
- decreased exposure of caregivers
- decreased environmental exposure and prevention of cross-contamination between patients

References
