



Linda Bell, RN, MSN  
Department Editor

## Is This Research Ready to Be Translated Into Practice?

Maureen Seckel, RN, MSN, APN, ACNS-BC, CCNS, CCRN

### Question

A recent published research study by Caruso et al<sup>1</sup> concluded that the routine instillation of sodium chloride before tracheal suctioning decreased the incidence of ventilator-associated pneumonia (VAP). My institution has worked hard to develop interdisciplinary evidence-based airway management guidelines and has finally achieved compliance with eliminating routine tracheal irrigation. Should sodium chloride instillation now be under consideration as part of a VAP prevention program or is this research ready to be translated into practice?

### Answer

The potentially harmful effects of instilling sodium chloride into the trachea during suctioning have been well documented in the literature<sup>2</sup> and include decreases in arterial and mixed venous oxygenation, hemodynamic changes, and patient discomfort, pain, and anxiety. Sodium chloride does not thin secretions nor does it mix with sputum.<sup>3-7</sup>

The relationship between sodium chloride solution instillation and VAP has not been well established. Prior to the current study, there has been 1 study that found increased dislodgement of bacterial colonies in the endotracheal tube after 5-mL sodium chloride irrigation in an *in vitro* model.<sup>8</sup> Bacteria encased in a biofilm in and around the endotracheal tube has been postulated as a cause of VAP pathogenesis. Disturbance of the biofilm from suctioning or irrigation may then uproot segments of biofilm and carry potentially resistant organisms into the lungs.<sup>9</sup> No mention of sodium chloride instillation as either a preventative strategy or causative agent in current VAP prevention guidelines has been found.<sup>8-12</sup>

### Review of Study

Caruso et al<sup>1</sup> used a prospective, randomized, controlled study design. The purpose of the study was to compare the incidence of VAP with or without sodium chloride instillation before suctioning.

### Study Sample

The authors studied 493 consecutive patients expected to be mechanically ventilated for more than 72 hours in a closed medical-surgical intensive care unit (ICU) in an oncologic hospital. After exclusions, 130 patients were allocated to the sodium chloride group and 132 patients to the control group.

---

Maureen Seckel is Clinical Nurse Specialist, Medical Pulmonary Critical Care, Christiana Care Health System, 4755 Ogletown-Stanton R, Newark, DE 19718 (MSeckel@Christianacare.org).

### Study Procedures

All suctioning (both sodium chloride and control groups) was done via closed tracheal suction catheter at 200 cm H<sub>2</sub>O negative pressure for 20 seconds after preoxygenation at 100% for 2 minutes by respiratory therapists only—nurses and physicians did not suction and were also blinded to sodium chloride use. In the sodium chloride group, 8 mL of sodium chloride solution was instilled through the instillation port before each suctioning episode. Indications for suctioning included visible secretions, ventilator-patient asynchrony, noisy breathing, increased peak airway pressures, and decreased tidal volumes. The study design mirrored current VAP preventative strategies including changing the closed tracheal suction catheters weekly or when soiled, use of heat and moisture exchangers or heated water humidifiers if contraindicated, instructions for head of bed (HOB) elevation at 45°, and ventilator circuit change only when soiled.

Ventilator-associated pneumonia was suspected when there was a new or worsening pulmonary infiltrate on chest radiograph, with at least 1 of the following symptoms: fever (>37.8°C), leukocytosis (>12 000 mm<sup>3</sup>), leukopenia (<4000 mm<sup>3</sup>), or purulent secretions. Bronchial alveolar lavage (BAL) was then performed, and microbiological VAP diagnosed if BAL fluid demonstrated bacterial load of 10<sup>4</sup> or more colony-forming units per milliliter.

### Key Results

Intensive care unit mortality, mechanical ventilator days, and length of stay were similar in both sodium chloride and control groups. Clinically suspected VAP was also similar in both the sodium chloride and control groups: 32 (24.6%) versus 42 (31.8%), *P* = .22. The incidence of microbiological VAP was, however, statistically significantly lower in the sodium chloride group: 14 (10.8%) versus 31 (23.5%), *P* = .008. The number of tracheal suctioning episodes (4.8 ± 1.2), endotracheal tube occlusions, heat and moisture exchangers changes due to secretions, and closed suction system changes due to secretions were similar in both groups.

### Discussion

The study was limited to patients in a medical-surgical ICU of an oncologic hospital in Brazil

and cannot be generalized to other ICU populations. The ICU mortality for both sodium chloride and control groups was high at 132 per 262 patients (50.8%), and the incidence of VAP was 15.44 per 1000 ventilator days. The VAP incidence was higher than the pooled mean per 1000 ventilator days for all types of ICUs reported by the National Healthcare Safety Network in the United States.<sup>13</sup> In addition, antibiotic use in this sample was high, with 188 per 262 (72%) use on admission and 258 per 262 (98.5%) use during ICU stay.

Although instructions for HOB elevation greater than 45° were part of the methodology for this study, there is no mention or measure of the staff's compliance. We know from the literature that there can be a discrepancy between maintaining and accurately assessing HOB elevation and that it takes a significant amount of education and performance improvement monitoring to achieve.<sup>14-16</sup> It is not clear whether this was part of the established standard of care for this ICU or a new practice specific to this study.

All patients in the study were evaluated for and suctioned only by a respiratory therapist and there was coverage in the ICU around the clock. Many ICUs share this task between nursing and respiratory therapy. Potentially, this single-provider method for suctioning could lead to delays, increased patient discomfort, and increased risk for VAP.

### Clinical Implications

The authors hypothesize that VAP was decreased in the sodium chloride group because of the frequent rinsing of the endotracheal tube leading to a decrease in the bacterial biofilm along with improved mobilization of secretions due to cough stimulation after sodium chloride instillation. The study results revealed statistically significantly less microbiologically diagnosed VAP in the sodium chloride instillation group. However, additional research is needed to establish the causal relationship between sodium chloride instillation and the endotracheal biofilm in addition to studying additional patient populations. The risk-benefit ratio of increasing pain and discomfort by the use of sodium chloride would need to be firmly evidence based. The use of routine sodium chloride irrigation during or before suctioning is not ready to be translated into practice at the bedside.

## References

1. Caruso P, Denari S, Ruiz SA, Demarzo SE, Deheinzelin D. Saline instillation before tracheal suctioning decreases the incidence of ventilator-associated pneumonia. *Crit Care Med*. 2009;37:32-38.
2. Halm MA, Kirsko-Hagel K. Instilling normal saline with suctioning: beneficial technique or potentially harmful sacred cow? *Am J Crit Care*. 2008;17:469-472.
3. Hanley M, Rudd T, Butler J. What happens to intratracheal saline instillations? *Am Rev Respir Dis*. 1978;117:124-128.
4. Bostick J, Wendelgass S. Normal saline instillation as part of the suctioning procedure: effects on PaO<sub>2</sub> and amount of secretions. *Heart Lung*. 1987;16:532-537.
5. Ackerman M, Gugerty B. The effect of normal saline bolus instillation in artificial airways. *J Soc Otorhinolaryngol Head Neck Nurses*. 1990;8:14-17.
6. Gray J, MacIntyre N, Kronenberger W. The effects of bolus normal-saline instillation in conjunction with endotracheal suctioning. *Respir Care*. 1990;35:785-790.
7. Reynolds P, Hoffman L, Schlichting R, Davies P, Zullo T. Effects of normal saline instillation on secretion volumes, dynamic compliance and oxygen saturation [abstract]. *Am Rev Respir Dis*. 1990;141:A574.
8. Hagler D, Traver G. Endotracheal saline and suction catheters: sources of lower airway contamination. *Am J Crit Care*. 1994;3:444-447.
9. American Thoracic Society and the Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med*. 2005;171:388-416.
10. Tablan OC, Anderson LJ, Besser R, et al. Guidelines for preventing health-care-associated pneumonia, 2003: recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee. *MMWR Recomm Rep*. 2004;53:1-36.
11. Muscedere J, Dodek P, Keenan S, Fowler R, Cook D, Heyland D. Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: diagnosis and treatment. *J Crit Care*. 2008;23:137-147.
12. American Association of Critical-Care Nurses. AACN practice alert: ventilator-associated pneumonia. *Crit Care Nurse*. 2008;28:83-85.
13. Edwards JR, Peterson KD, Andrus ML, Dudeck MA, Pollock DA, Horan TC. National Healthcare Safety Network (NHSN) report, data summary for 2006-2007, issued November 2008. *Am J Infect Control*. 2008;36:609-626.
14. Grap MJ, Munro CL. Preventing ventilator-associated pneumonia: evidence-based care. *Crit Care Nurs Clin North Am*. 2004;16:349-358.
15. Grap MJ, Munro CL, Hummell RS, Elswick RK, McKinney JL, Sessler CN. Effect of backrest elevation on the development of ventilator-associated pneumonia. *Am J Crit Care*. 2005;14:325-333.
16. Grap MJ, Munro CL. Quality improvement in backrest elevation. *AACN Clin Issues*. 2005;16:133-139.