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Subglottic secretion aspiration in the prevention of ventilator-associated pneumonia: A review of the literature.

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Subglottic Secretion Aspiration in the Prevention of Ventilator Associated Pneumonia:

A Review of the Literature

Acknowledgments: Deborah Becker PhD, CRNP, BC

Abstract

Ventilator associated pneumonia (VAP) is a common nosocomial infection that results in both negative patient outcomes and increased healthcare costs. Recently many efforts have been targeted at VAP prevention including the practice of subglottic secretion aspiration. Six randomized control studies examining the effectiveness of subglottic secretion aspiration in the prevention of ventilator-associated pneumonia were reviewed. Results consistently show that subglottic secretion aspiration significantly reduces the incidence of VAP in a variety of patient populations. Despite these findings, this practice is limited in clinical settings. This clinical practice should be implemented in individuals requiring mechanical ventilation in order to reduce the incidence of ventilator-associated pneumonia.

Ventilator associated pneumonia (VAP) is a common nosocomial infection that results in both negative patient outcomes and increased healthcare costs. VAP is the most commonly diagnosed nosocomial infection among mechanically ventilated patients affecting 10-20 % of this specific patient population.¹

A recent systematic review found that patients who acquired VAP spent an additional five to seven days requiring care in the intensive care unit (ICU) and had a 15 to 50 percent higher mortality rate when compared with those who did not develop VAP. In addition, the diagnosis of VAP was associated with increased health care cost ranging from \$10,000 to \$13,000 per case. Costs associated with VAP have been predicted to accrue to 1.5 billion health care dollars annually.¹

In the past decade, large-scale initiatives have been employed by healthcare workers to target VAP prevention. Of recent interest is the role of subglottic secretions in the pathogenesis of nosocomial pneumonia. Studies have confirmed that bacteria that pools above the endotracheal cuff provides a mechanism for bacterial proliferation. The translocation of these secretions past the endotracheal tube cuff and into the lung parenchyma contributes to the development of VAP.²

In 1992, the Hi Lo Evac tube was developed by Nellcor Puritan Bennett Incorporated in order to provide a mechanism to remove subglottic secretions.³ This specialized endotracheal tube contains an additional lumen that terminates above the tracheal cuff and connects to an external suctioning port, allowing the removal of secretions from the subglottic region. Although intended for continuous suction, subglottic secretion evacuation can be achieved through various methods including continuous, intermittent, or manual aspiration.

Since it's introduction into the medical community, many studies have examined the efficacy and effectiveness of subglottic secretion aspiration. The purpose of this review is to assess the impact of subglottic secretion aspiration on the prevalence of VAP and to examine the implications of this technology in the context of current medical practice.

METHODS

Study Selection

The University of Pennsylvania's Ovid interface was used to produce relevant articles. Specifically MEDLINE, CINAHL and the Cochrane library databases were searched. Keywords used in the search included subglottic suctioning, subglottic drainage, and subglottic secretion. Studies were limited to randomized clinical trials that were printed in English and published between January 1992 and November 2008. Studies were further limited to those that included clinical outcome measurements.

Data Synthesis

The primary outcome of interest was prevalence of VAP. Secondary outcome measurements varied by study. Common shared endpoints included ICU and hospital lengths of stay, mortality rate, length of time requiring mechanical ventilation and time until VAP diagnosis. Studies were examined based on sample, treatment variable, outcome measures, findings, and comments (Table 1).

Results

After the initial search query a total of fifteen studies were identified. From these findings, six studies^{4, 5, 6, 7, 8, and 9} met the inclusion criteria. Three studies were excluded for not being published in English, two studies were excluded for examining alternative

endpoints, and four studies were excluded for not using subglottic secretion drainage as the experimental variable.

Participants

A total of 1848 patients were studied in the six clinical trials. All participants required mechanical ventilation. Patient populations varied by study and included patients with a wide variety of medical conditions. Reasons for mechanical intubation included post-surgical management, acute respiratory failure, shock, cardiac failure, community-acquired pneumonia, neurological disease and trauma.

Treatment

The treatment group in each trial received some form of subglottic secretion aspiration. However, the specific mechanism varied between studies including continuous, intermittent, or manual evacuation of subglottic secretions. The studies outlined in detail the exact protocol used for subglottic secretion aspiration (Table 1).

Control groups received standard endotracheal tube (ETT) care without subglottic suctioning. Additional variables included randomization of various types of gastrointestinal prophylaxis in one study ⁴, and the concurrent use of a polyurethane cuff in another study ⁵. Each study specified the process in which randomization was ensured.

Findings

Participants of each study were found to have similar demographic findings between the control and treatment groups. No significant statistical difference was demonstrated between age, gender, comorbidities, reason warranting mechanical ventilation, Acute Physiology and Chronic Health Evaluation (APACHE) II or Simplified Acute Physiology (SAP) scores. Of note one study found a disproportionate amount of

patients who received a specific type of cardiovascular surgery in the control group versus the treatment group ⁹, however, this variable was not thought to affect the study results.

Although the findings varied by study, the percentage of patients in the treatment group who developed VAP was lower than the percentage of patients who developed VAP in the control groups, in all six studies. In addition, four out of the six studies found that patients who received subglottic secretion aspiration had a later onset of VAP diagnosis. ^{[4], [5], [6] and [8]} No adverse events due to subglottic secretion aspiration were reported. Mixed statistically significant findings were reported in the additional secondary endpoints.

Implications for Clinical Practice

Aspiration of subglottic secretions has been widely accepted by recommending agencies and has been incorporated in VAP prevention guidelines. Currently the American Thoracic Society recommends the use of continuous aspiration of subglottic secretions to combat VAP as a Level I recommendation, the highest level of evidence in their grading system. ¹⁰ In addition, the American Association of Critical Care Nurses recommends that subglottic secretion aspiration be incorporated into standard nursing care ¹¹.

Despite research confirming the benefits of subglottic secretion aspiration in VAP prevention, significant obstacles have prevented the dissemination of this practice into routine patient care. One study found that nurses performed subglottic secretion aspiration a mere 17.6 % of the time. ¹² Reasons for failure to provide subglottic suctioning included lack of availability of equipment and perception that subglottic

suctioning may cause either patient discomfort or adverse side effects. A small percentage of nurses reported refrain from enforcing VAP guidelines due to disagreement with clinical trial results.

In lieu of the increase in knowledge about ventilator associated pneumonia prevention strategies, this nosocomial infection still affects a large number of patients in intensive care units throughout the country. Nurses and other healthcare workers have an important role in the promotion of VAP prevention including implementing a unit-based protocol for the practice of subglottic secretion aspiration. Moreover endotracheal tubes that are equipped to provide subglottic secretion aspiration should be readily available in areas where intubation occurs frequently including emergency departments, operating rooms, intensive care units, and pre-hospital settings.

Discussion

Subglottic secretion aspiration has been widely studied by randomized control trials in a large variety of patient populations including both medical and surgical patients. Findings have shown that this simple technology is effective in preventing the development of ventilator-associated pneumonia. Of the 1848 patients studied, no adverse events associated with subglottic secretion aspiration were reported. In addition, findings have consistently shown that patients who receive subglottic secretion aspiration have a delayed onset of nosocomial pneumonia. This finding demonstrates an added benefit in patients who may require mechanical ventilation for a shorter period of time.

In conclusion, subglottic secretion aspiration is both a safe and effective therapy. It should be implemented in individuals requiring mechanical ventilation in order to

reduce the incidence of ventilator-associated pneumonia in this vulnerable patient population.

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