



Review

Prophylactic oral health procedures to prevent hospital-acquired and ventilator-associated pneumonia: A systematic review



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ABSTRACT

Objectives: Given the severity of hospital-acquired pneumonia and ventilator-associated pneumonia, the purpose of this systematic review was to identify various oral health procedures, in intensive care unit or nursing home setting, shown to help reduce the incidence of hospital-acquired and ventilator-associated pneumonia.

Design: Randomized controlled trials evaluating the efficacy of at least one prophylactic oral health procedure in reducing hospital-acquired pneumonia or ventilator-associated pneumonia were included.

Data sources: MEDLINE, EMBASE, and CINAHL were searched for relevant studies. In addition, references of studies included for full-text review were examined for potentially relevant studies. Grey literature was searched for by reviewing the first 200 results obtained in Google Scholar™.

Review methods: Two authors conducted study selection and data extraction for this review. The Cochrane risk of bias tool was applied to assess the quality of the included trials (namely sequence generation, allocation concealment, blinding, the completeness of data assessment, the lack of selective reporting, and the lack of other miscellaneous biases) based on the information in the original publications. An assessment of a high, unclear, or low risk of bias was assigned to each domain.

Results: Through review of the 28 trials included in this review, we found that good oral health care was suggested to be associated with a reduction in the risk for hospital-acquired and ventilator-associated pneumonia in high-risk patients. Furthermore, through the review of studies evaluating the efficacy of chlorhexidine, we found that, despite the presence of mixed results, that chlorhexidine may be a particularly effective means of lowering the risk for hospital-acquired and ventilator-associated pneumonia. The efficacy of other prophylactic oral health techniques such as the use of tooth brushing or iodine swab was uncertain.

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Conclusions: Current evidence suggests that chlorhexidine rinses, gels and swabs may be effective oral disinfectants in patients at high risk for hospital-acquired and ventilator-associated pneumonia. The evidence supporting the effectiveness of other oral care means still remains scarce and methodologically weak. As such, efforts to promote the increase of high-quality studies and to support nursing educational efforts to promote the dissemination of evidence-based knowledge of oral prophylaxis into clinical practice are warranted.

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What is already known about this topic?

- A review by our team in 2006 indicated that though there is some evidence to demonstrate the effectiveness of oral prophylactic measures in preventing hospital-acquired and ventilator-associated pneumonia. Nevertheless, the evidence was found to be weak, indicating a need to update the review.

What does this paper add?

- This paper serves as an update to our previous systematic review in 2006. Through this review, we found that the current evidence suggests that chlorhexidine rinses, gels and swabs may be effective oral disinfectants in patients at high risk for hospital-acquired and ventilator-associated pneumonia.

1. Background

Since the release of the United States Surgeon General's Report at the start of the millennium, there has been a rise in the interest to determine the relationship between oral health and various systemic diseases (U.S. Department of Health and Human Services, 2000). One such area that has been of interest to dentists and nurses alike has been the connection between oral health and respiratory disease, with a focus on hospital-acquired pneumonia.

Pneumonia, an acute illness, is defined by the Centers for Disease Control and Prevention (2014) as "an infection of the lungs that can cause mild to severe illness in people of all ages". Reported to be responsible for approximately 15% of all hospital-acquired infections and 13–48% of nursing home-associated infections, hospital-acquired pneumonia is the second most common nosocomial infection immediately following urinary tract infections, and accounts for 20–33% attributable mortality rates (Coffin et al., 2008; Healthcare Infection Control Practices Advisory Committee, 2004). As with most nosocomial infections, hospital-acquired pneumonia is reported to occur more frequently among high-risk individuals including patients within the extremes of age or have a severe underlying disease (Healthcare Infection Control Practices Advisory Committee, 2004).

There are four possible routes of contamination of the lower airways by microorganisms: (1) through aspiration of food, oropharyngeal secretions, or gastric contents, (2) through spread of infections from contagious sites, (3) through inhalation of infectious aerosols; or (4) through hematogenous spread from extrapulmonary sources of

infection (Taylor et al., 2000). Nonetheless, aspiration of colonized secretions from the oropharynx into the upper airway remains to be the primary mechanism by which microorganisms (such as *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Staphylococcus aureus* and *Enterobacter*) enter the lungs (Amin et al., 2004; Marik, 2001).

Patients within an Intensive Care Unit who require mechanical ventilation are especially susceptible to acquiring pneumonia (Leroy and Soubrier, 2004). Onsets of pneumonia as a consequence of mechanical ventilation are commonly referred to as ventilator-associated pneumonia. Even with adequate treatment, ventilator-associated pneumonia is associated with high morbidity and mortality rates, conferring mortality rates of over 10% (Coffin et al., 2008). In Canada, there are approximately 4000 cases of ventilator-associated pneumonia reported annually, resulting in an average of 230 deaths per year (Muscedere et al., 2008). The incidence of ventilator-associated pneumonia is 10.6 cases per 1000 ventilator days, with an average increase in intensive care unit stay of 4.3 days (Muscedere et al., 2008). Accounting for approximately 17,000 intensive care unit days per year, it is estimated that ventilator-associated pneumonia in turn is responsible for nearly \$46 million per year in inpatient costs (Muscedere et al., 2008).

In 2006, our team performed a systematic review to examine the evidence regarding an etiological association between oral health indicators and pneumonia or other respiratory diseases (Azarpazhooh and Leake, 2006). Searching for studies published in 2005 or earlier, they identified 10 clinical trials evaluating the effectiveness of prophylactic oral health procedures in reducing the progression of occurrence of pneumonia. Of the 10 included studies, 7 were randomized controlled trials (RCTs) and 3 were non-randomized trials. Though they were unable to pool the included studies' results in a meaningful manner due to the large variation in the methodologies of the included studies, they were able to provide data supporting a positive association between improved oral health and the reduction in the progression or occurrence of respiratory diseases among high-risk patients in intensive care units and nursing homes. Given the significant negative impact of hospital-acquired and ventilator-associated pneumonia on the health care system, this review aimed to (1) update our previous systematic review and review the most recent evidence to further verify the reversibility between poor oral health and pneumonia, and (2) to identify various oral health techniques shown to help reduce the incidence of hospital-acquired pneumonia and ventilator-associated pneumonia.

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