

Preventing Aspiration Pneumonia in High-Risk Nursing Home Residents: Role of Chlorhexidine-Based Oral Care Questioned Again

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(See the Major Article by Juthani-Mehta et al on pages 849–57.)

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Pneumonia generally occurs following aspiration of microorganisms from the oral cavity or nasopharynx. Aspiration pneumonia is common in the nursing home population and is often associated with oropharyngeal dysphagia and regurgitation of gastric contents [1]. Dental plaque has been particularly studied as a source of bacteria that may cause respiratory infections. A study in Japan showed an association between periodontal disease and increased mortality from pneumonia [2]. Another study of 137 nursing home residents revealed that 58% had extensive oral needs, and 30% reported a severe impact on their oral health–related quality of life [3]. Inadequate oral care significantly increases the risk for developing pneumonia and, based on an elegant paper published almost a decade ago in this journal [4], is considered to be a modifiable risk factor.

Several preliminary studies suggest that adequate oral hygiene using mouth

rinses, toothpaste, and brushing, along with feeding in an upright position, would mitigate the risk of pneumonias attributed to aspiration. Studies from acute care support the role of chlorhexidine rinses and semirecumbent positioning to reduce aspiration pneumonia [5]. A recent systematic review assessed the effects of oral healthcare on the incidence of patients with ventilator-associated pneumonia receiving mechanical ventilation in intensive care units (ICUs) and showed that either chlorhexidine rinse or gel is associated with a 40% reduction in ventilator-associated pneumonia in critically ill patients [6]. Another systematic review of randomized controlled trials focusing on aging populations revealed that oral hygiene had positive preventive effects on pneumonia and respiratory tract infections in elderly hospitalized patients and nursing home residents, with absolute risk reductions of 6.6%–11.7% [7]. Furthermore, a study of 143 residents in a Veterans Affairs nursing home investigated the association between the assignment of an oral hygiene aide and mortality from pneumonia, and found that the odds of dying from pneumonia in the group that did not receive oral care was >3 times that of the group receiving oral care (odds ratio, 3.57; $P = .03$) [8, 9]. However, the current study challenges this notion.

The article by Juthani-Mehta et al in this issue of *Clinical Infectious Diseases* represents a robust execution of an interventional study in a setting where conducting research is challenging and difficult, yet rewarding and much needed [10]. In this well-designed cluster-randomized study involving 36 nursing homes in Connecticut, Juthani-Mehta et al recruited older nursing home residents with at least 1 of the 2 modifiable risk factors, impaired oral hygiene or swallowing difficulty, as assessed by clinical data as well as oral examinations. The focus of this study was nursing home residents with at least 1 month of stay in the facility. The intervention comprised of manual tooth/gum brushing along with a chlorhexidine rinse twice a day along with upright positioning. Most exclusion criteria were appropriate, although exclusion of residents with percutaneous endoscopic gastrostomy or nasogastric tubes is debatable. Residents with these devices are known to have higher oropharyngeal colonization with pathogens and may have benefited from this intervention [11]. Study participants were then followed for a maximum of 2.5 years, with a mean duration of follow-up of 1.13 years. Primary and secondary outcomes included time to first chest radiograph–confirmed pneumonia and development of first lower respiratory

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tract infection (LRTI), respectively. Adherence to the protocol was excellent, with 88% adherence to chlorhexidine use, 75% to toothpaste use, and 100% to upright feeding when observed. The study was terminated for futility as the conditional power under observed treatment difference was nearly zero.

Despite showing a lack of benefit, this study achieved many laudable goals and has broad-ranging implications. Basic oral health is crucial to all and particularly important for older adults with frailty and disability who are unable to care for themselves. Although quality of life was not assessed by this study, oral health is critical to good health. However, the study does suggest that an intervention that used chlorhexidine rinses, manual tooth/gum brushing, and upright positioning during feeding was not effective in reducing LRTIs; thus, the utility of this particular enhanced oral care protocol in long-term populations is in question. Future studies should address whether these protocols with or without chlorhexidine have a role in reducing oropharyngeal colonization, particularly in residents with nasogastric and enteral feeding tubes. Second, despite challenges in conducting thorough randomized controlled studies in nursing homes, including issues unique to this kind of protocol such as lack of a designated person to provide oral care, limited training in oral care among nurse aide personnel, potential resident noncompliance due to behavioral issues, and lack of dental coverage, the investigative team was able to conduct study procedures with high adherence rates. Third, much too often, nursing home policies are adopted from acute care due to the lack of strong evidence. Studies such as these are crucial to establish best practices and discard ineffective practices for our older frail population.

Importantly, the current study adds more steam to the ongoing controversy of the value of chlorhexidine-based oral care. In a recently published meta-analysis, Klompas et al evaluated the effectiveness

and safety of chlorhexidine oral care in preventing ventilator-associated pneumonia among ICU patients [12]. They concluded that oral care with chlorhexidine may prevent nosocomial pneumonias in cardiac surgery patients who are intubated for shorter periods of time, but did not decrease the risk of ventilator-associated pneumonia in non-cardiac surgery patients who were likely intubated for longer periods. Notably and perhaps for the first time, they showed a statistically nonsignificant increase in mortality among ICU patients randomized to receive chlorhexidine oral care with a potential dose-response effect [12, 13].

Several limitations, albeit minor, are worth noting. First, study adherence was largely evaluated quantitatively by the measuring the amounts of chlorhexidine and toothpaste use. Thus, qualitative assessment of adherence to the technique by nursing staff or participation levels by residents was missing. Second, upright positioning during feeding is now routinely practiced in all nursing homes, making the intervention and control nursing homes alike in this aspect, making it difficult to assess tangible benefits of upright positioning in preventing pneumonia. Third, evaluation of interim outcomes such as reduction in oral colonization with pathogenic organisms, reduction in physician-diagnosed pneumonia, reduced overall antibiotic use by facilities, or improved quality of life as measured by resident and family interviews might be helpful to guide future studies.

Limitations notwithstanding, this is an exciting advance in nursing home research and opens the door to conducting long-term, meaningful studies that inform the policy and practice of infection prevention in this setting.

Notes

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