KIMBERLY-CLARK*
Oral Care Systems

A Clinical Compendium

Oral Care Is Critical Care

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Pneumonia Classifications

Epidemiology and outcomes of health-care-associated pneumonia: results from a large US database of culture-positive pneumonia.

Kollef MH, Shorr A, Tabak YP, Gupta V, Liu LZ, Johannes RS.
Chest. 2005 Dec;128(6):3854-3862.

Background/ Rationale

Traditionally, pneumonia developing in patients outside the hospital is categorized as community acquired, even if these patients have been receiving health care in an outpatient facility. Accumulating evidence suggests that health-care-associated infections are distinct from those that are truly community acquired.

Objective

To characterize the microbiology and outcomes among patients with culture-positive community-acquired pneumonia (CAP), health-care-associated pneumonia (HCAP), hospital-acquired pneumonia (HAP), and ventilator-associated pneumonia (VAP).Design and setting: A retrospective cohort study based on a large US inpatient database.

Design

A total of 4,543 patients with culture-positive pneumonia admitted into 59 US hospitals between January 1, 2002, and December 31, 2003, and recorded in a large, multi-institutional database of US acute-care hospitals (Cardinal Health-Atlas Research Database; Cardinal Health Clinical Knowledge Services; Marlborough, MA).

Methods

Main measures: Culture data (respiratory and blood), in-hospital mortality, length of hospital stay (LOS), and billed hospital charges.

Results

Approximately one half of hospitalized patients with pneumonia had CAP, and > 20% had HCAP. Staphylococcus aureus was a major pathogen in all pneumonia types, with its occurrence markedly higher in the non-CAP groups than in the CAP group. Mortality rates associated with HCAP (19.8%) and HAP (18.8%) were comparable ($p > 0.05$), and both were significantly higher than that for CAP (10%, all $p < 0.0001$) and lower than that for VAP (29.3%, all $p < 0.0001$). Mean LOS varied significantly with pneumonia category (in order of ascending values: CAP, HCAP, HAP, and VAP; all $p < 0.0001$). Similarly, mean hospital charge varied significantly with pneumonia category (in order of ascending value: CAP, HCAP, HAP, and VAP; all $p < 0.0001$).

Conclusions

The present analysis justified HCAP as a new category of pneumonia. Saureus was a major pathogen of all pneumonias with higher rates in non-CAP pneumonias. Compared with CAP, non-CAP was associated with more severe disease, higher mortality rate, greater LOS, and increased cost.

PubMed ID

16354854

Protocol Recommendations and Compliance

Survey of oral care practices in US intensive care units.

Binkley C, Furr LA, Carrico R, McCurren C.
Am J Infect Control. 2004 May;32(3):161-9.

Background/ Rationale

Research has shown that oral care involving toothbrushes and topical antimicrobials improves the oral health of medically compromised patients and may reduce the incidence of nosocomial infections including pneumonia.

Objective

To determine the type and frequency of oral care in intensive care units (ICUs) in the United States and the attitudes, beliefs, and knowledge of health care workers.

Design

Survey research

Methods

A randomly selected survey of 102 ICUs within the continental United States participated with 556 respondents; 97% of respondents were registered nurses.

Measurements

Frequency and type of oral care provided, attitudes and beliefs, and knowledge and training in oral care were measured.

Results

Ninety-two percent of respondents perceived oral care to be a high priority. The primary methods of oral care involved the use of foam swabs, moisturizers, and mouthwash. Toothbrushes and toothpaste were used infrequently by almost 80% of respondents. The majority of nurses indicated a need for research-proven oral care standards and desired to learn more.

Conclusions

In this random sample of ICUs, oral care methods were not consistent with current research and oral care protocols. The translation of oral care research into practice in the ICU may improve the quality of care and decrease the incidence of ventilator-associated pneumonia.

PubMed ID

15153928

Protocol Recommendations and Compliance

Improving oral care in patients receiving mechanical ventilation.

Cutler CJ, Davis N.
Am J Crit Care. 2005 Sep;14(5):389-94.

Background/ Rationale

Comprehensive oral care is an evidence-based prevention strategy to reduce the risk of ventilator-associated pneumonia in patients receiving mechanical ventilation. Until recently, no comprehensive guidelines or standards existed to define necessary tasks, methods, and frequency of oral care to provide patients with optimal results.

Objective

To observe current practice of, define best practice for, and measure compliance with standardized comprehensive oral care.

Design

Observational study

Subjects/Patients

253 patients

Methods

This observational study was part of a larger research study performed at 5 acute care hospitals. Time blocks of 4 hours were randomized over 8 intensive care units and the 7 days of the week. Baseline data were collected before implementation of multifaceted education on an oral-cleansing protocol; interventional data were collected afterward.

Results

Oral care practices were observed for 253 patients. During the baseline period, oral cleansing was primarily via suction swabs. Toothbrushing and moisturizing of the oral tissues were not observed. Only 32% of the patients had suctioning to manage oral secretions. During the interventional period, 33% of patients had their teeth brushed, 65% had swab cleansing, and 63% had a moisturizer applied to the oral mucosal tissues. A total of 61% had management of oral secretions; 38% had oropharyngeal suctioning via a special catheter.

Conclusions

Implementation of an evidence-based oral cleansing protocol improved the care of patients receiving mechanical ventilation. Multifaceted education and implementation strategies motivated staff to increase oral care practices.

PubMed ID

16120890

Protocol Recommendations and Compliance

Oral care in the adult intensive care unit.

Fitch JA, Munro CL, Glass CA, Pellegrini JM.
Am J Crit Care. 1999 Sep;8(5):314-8.

Background/ Rationale

Nurses have not been formally trained in assessing the oral status of patients in intensive care units, and no oral care protocols for these patients are available.

Objective

To assess the oral status of patients in an intensive care unit, evaluate the effects of a defined oral care protocol on the oral health status of patients in an intensive care unit, and compare oral assessments of a dental hygienist with those of intensive care nurses.

Design

A nonequivalent comparison group, longitudinal design

Subjects/Patients

Patients in an ICU

Methods

In phase 1, oral assessment data on the comparison group were collected by a dental hygienist. In phase 2, nurses were instructed in oral assessment and an oral care protocol. In phase 3, the oral care protocol was implemented in the treatment group, and oral assessment data were collected separately by the dental hygienist and by nurses.

Results

The mean inflammation score was significantly lower (t test P =.03) in the treatment group (mean, 3.9; SEM, 3.0) than in the comparison group (mean, 12.4; SEM, 2.2). Although not significant, the mean scores of the treatment group were also lower than those of the comparison group on scales of candidiasis, purulence, bleeding, and plaque. Correlations between scores for individual items on the oral assessment tool obtained by the dental hygienist and those obtained by nurses were all greater than 0.6386.

Conclusions

Implementation of a well-developed oral care protocol by bedside nurses can improve oral health of patients in the intensive care unit.

PubMed ID

10467468

Protocol Recommendations and Compliance

The effect of a comprehensive oral care protocol on patients at risk for ventilator-associated pneumonia

Schleder B, Stott K, Lloyd RC.
Journal of Advocate Health Care. 2002 Apr; 4(1):27-30.

Objective

To evaluate the impact of a comprehensive oral care protocol on the VAP rate in adult ICU patients.

Design

The study population included all adult mechanically ventilated patients in Advocate Good Shepherd Hospital's 10-bed Medical/ Surgical Intensive Care Unit (ICU).

Methods

A pre/post comparison test was conducted using Statistical Process Control (SPC) methods. The VAP rates prior to implementing the new oral hygiene protocol were compared to the rates after the process was changed. If the VAP rate declined after the protocol was introduced, then the control chart, a u-chart, will document the nature and extent of the change.

Results

The VAP rate during the baseline period was 5.6 VAPs per 1,000 ventilator days with a comparative reference mean rate from the NNIS database being 9.9 per 1,100 vent days from Dec. 1999. After the protocol was introduced, the VAP rate dropped to 2.2 per 1,000 vent days with a comparative reference mean rate from the NNIS database being 8.7 per 1,000 vent days from Dec. 2001.

Conclusions

The new oral hygiene procedure tested in this study included components that address three risk factors (bacterial colonization of the oropharyngeal area, aspiration of subglottal secretions and colonization of dental plaque with respiratory pathogens). While it was not possible to differentiate which of these factors or combinations of factors had the greatest effect on lowering the VAP rate, the preliminary data suggest that the mere reduction of risk through better oral hygiene can lead to fewer VAPs.

PubMed ID

Not Available.

Barriers to Care

Nurses' implementation of guidelines for ventilator-associated pneumonia from the Centers for Disease Control and Prevention.

Cason CL, Tyner T, Saunders S, Broome L; Centers for Disease Control and Prevention.
Am J Crit Care. 2007 Jan;16(1):28-36; discussion 37; quiz 38.

Background/ Rationale

Ventilator-associated pneumonia accounts for 47% of infections in patients in intensive care units. Adherence to the best nursing practices recommended in the 2003 guidelines for the prevention of ventilator-associated pneumonia from the Centers for Disease Control and Prevention should reduce the risk of ventilator-associated pneumonia.

Objective

To evaluate the extent to which nurses working in intensive care units implement best practices when managing adult patients receiving mechanical ventilation.

Methods

Nurses attending education seminars in the United States completed a 29-item questionnaire about the type and frequency of care provided.

Results

Twelve hundred nurses completed the questionnaire. Most (82%) reported compliance with hand-washing guidelines, 75% reported wearing gloves, half reported elevating the head of the bed, a third reported performing subglottic suctioning, and half reported having an oral care protocol in their hospital. Nurses in hospitals with an oral care protocol reported better compliance with hand washing and maintaining head-of-bed elevation, were more likely to regularly provide oral care, and were more familiar with rates of ventilator-associated pneumonia and the organisms involved than were nurses working in hospitals without such protocols.

Conclusions

The guidelines for the prevention of ventilator-associated pneumonia from the Centers for Disease Control and Prevention are not consistently or uniformly implemented. Practices of nurses employed in hospitals with oral care protocols are more often congruent with the guidelines than are practices of nurses employed in hospitals without such protocols. Significant reductions in rates of ventilator-associated pneumonia may be achieved by broader implementation of oral care protocols.

PubMed ID

17192524

Barriers to Care

A survey of the oral care practices of intensive care nurses.

Jones H, Newton JT, Bower EJ.
Intensive Crit Care Nurs. 2004 Apr;20(2):69-76.

Background/ Rationale

Intensive care unit (ICU) patients have complex oral care needs. Inadequate oral care may predispose ICU patients to nosocomial infections. Recent initiatives have sought to improve the quality and evidence base of ICU oral care provision.

Objective

To describe the current priority given to oral care, the knowledge and practice of oral needs assessment and oral care methods, and adherence to the local ICU oral care protocol of ICU nurses working in one hospital.

Design

Questionnaire Survey

Subjects/Patients

103 nurses working in adult ICU

Methods

Self-administered questionnaire survey of all nurses working in adult ICU (n = 160).

Results

Replies were received from 103 (response rate 64.5%). On average, oral care was given a similar priority to other aspects of personal care. 13.5% nurses rated oral care as a low priority. Whilst 98% nurses routinely performed an oral needs assessment, only 26% used a written assessment tool. Toothbrushes were used at least once a day by 85.5% nurses and chlorhexidine products were routinely used by 50.5% nurses. The oral care practices of most nurses matched the local ICU protocol. 23.5% nurses had received no training in oral care and 58% nurses requested initial/further training.

Conclusions

Most oral care methods were appropriate, based on the available evidence. A small minority of nurses gave oral care a low priority and were not using evidence-based oral care methods recommended in the local ICU protocol. Encouraging the general use of oral needs assessment tools is a priority, and further oral care training is required.

PubMed ID

15072774

HAP/Oral Care Connection

Oral care and pneumonia.

Yoneyama T, Yoshida M, Matsui T, Sasaki H,
and the Oral Care Working Group.
Lancet. 1999 Aug 7; 354: 515.

Background

D Simons and colleagues (May 22, p 1761)1 report poor oral status of the institutionalised elderly in the UK, which may contribute to the eating disorders and low nutrient and vitamin C concentration in this group. Since aspiration of bacteria in oropharyngeal secretions is an important risk factor for nonsocomial pneumonia in the elderly, 2 poor oral health may also contribute to the development of pneumonia.

Objective

To determine whether oral care lowers the frequency of pneumonia in the institutionalized elderly

Design

Prospective

Subjects/Patients

Elderly people receiving oral care and in those who did not receive oral care who were selected from 11 nursing homes.

Methods

Nurses or care-givers cleaned their teeth by toothbrush after each meal, and scrubbed the pharynx with an applicator with povidone iodine (1%) every day. Dentists assessed oral status once a week for the oral-care group. Before the study, all participants underwent physical examination and chest radiography. Participants were randomly (by random numbers table) assigned oral care or no active treatment in September, 1996, and were followed up for 2 years. Criteria for diagnosis of pneumonia were new pulmonary infiltrate seen on chest radiograph, and cough, temperature higher than 37·8ºC, or subjective dyspnoea. Two radiologists not involved in the study diagnosed pneumonia. 51 people were excluded from analysis because they died from causes other than pneumonia during follow-up. Of the remaining 366 people, 184 (mean age 82 years [SD 7]) received oral care at study entry and 182 (mean age 82 years [7]) received no active oral care.

Results

During follow-up, pneumonia was diagnosed in 34 (19%) participants who did not receive oral care and 21 (11%) of those who received oral care. Relative risk of developing pneumonia on no active oral care compared with oral care was 1·67 (95% CI 1·01–2·75, p=0·04).

Conclusions

Oral care lowered the risk of pneumonia in institutionalized elderly. This finding underscores the necessity for the monitoring of specific oral hygiene courses for nurses and caregivers.

PubMed ID

10465203

HAP/Dental Plaque Connection

Colonization of dental plaque: a source of nosocomial infections in intensive care unit patients.

Fourrier F, Duvivier B, Boutigny H, Roussel-Delvallez M, Chopin C.
Crit Care Med. 1998 Feb;26(2):301-8.

Objective

To study the dental status and colonization of dental plaque by aerobic pathogens and their relation with nosocomial infections in intensive care unit (ICU) patients.

Design

A prospective study in a medical ICU of a university-affiliated hospital.

Subjects/Patients

Consecutive patients admitted to the ICU during a 3-mo period.

Interventions

Dental status was assessed by the same investigator using a score adapted from the "Caries-Absent-Occluded" (CAO) index (referred to in the U.S. as DMFT [Decayed-Missing-Filled Teeth] index). The amount of dental plaque on premolars was assessed using a semiquantitative score. Quantitative cultures of dental plaque, nasal secretions, tracheal aspirates, and urine were done at admission (day 0) and every fifth day until death or discharge. An additional study was done in eight patients to serially compare dental plaque, salivary, and tracheal aspirate cultures during a 2-wk period.

Measurements and Main Results

Fifty-seven patients were included in the main study. Due to the variability in their ICU stay, 29 patients could be examined on day 0 only (group A), 15 patients on days 0 and 5 (group B), and 13 patients on days 0, 5, and 10 (group C). The mean dental CAO score was 16 +/- 8 and did not change during the ICU stay. The dental plaque score was < or =1 in 70% of patients on day 0; > or =2 in 50% of patients on day 5; and > or =2 in 90% of patients on day 10. Dental plaque cultures were positive at 10(3) colony-forming units/mL for aerobic pathogens in 23% of patients on day 0; 39% of patients on day 5; and 46% of patients on day 10. In groups B and C, mean dental plaque score and frequency of plaque colonization increased from days 0 to 5 and from days 5 to 10. A high bacterial concordance was found between dental plaque and tracheal aspirate cultures, and in the additional study, between salivary and dental plaque cultures. Twenty-one patients developed a nosocomial infection in the ICU. Dental plaque colonization on days 0 and 5 was significantly associated with the occurrence of nosocomial pneumonia and bacteremia (sensitivity 0.77; specificity 0.96; positive predictive value 0.87; negative predictive value 0.91; relative risk 9.6). In six cases of nosocomial infection, the pathogen isolated from dental plaque was the first identified source of nosocomial infection.

Conclusions

The amount of dental plaque increased during the ICU stay. Colonization of dental plaque was either present on admission or acquired in 40% of patients. A positive dental plaque culture was significantly associated with subsequent nosocomial infections. Dental plaque colonization by aerobic pathogens might be a specific source of nosocomial infection in ICU patients.

PubMed ID

9468169

HAP/Dental Plaque Connection

Colonization of dental plaque by respiratory pathogens in dependent elderly.

Sumi Y, Miura H, Michiwaki Y, Nagaosa S, Nagaya M.
Arch Gerontol Geriatr. 2007 Mar-Apr;44(2):119-124. Epub 2006 May 24.

Objective

The purpose of this study was to assess the existence of oral infectious pathogens potentially causing the respiratory disease in the dependent elderly.

Subjects/Patients

138 dependent elderly

Methods

The dental plaques of 138 dependent elderly were examined to identify microorganisms by the culture method.

Results

Twenty-one species of microorganisms were detected in the dental plaques in this study. In 89 cases out of 138 (64.5%), potential respiratory pathogens colonized in the dental plaques of the dependent elderly.

Conclusions

The results of the present study revealed that bacteria that commonly cause respiratory infection colonized in dental plaques of the aged, dependent subjects. Therefore, dental plaques must be considered a specific reservoir of colonization and subsequent aspiration pneumonia in dependent elderly.

PubMed ID

16723159

VAP/Oral Care Connection

Reduction of microbial colonization in the oropharynx and dental plaque reduces ventilator-associated pneumonia.

Garcia R, Jendresky L, Colbert L.
Journal Poster Presented at APIC Conference, June 2004.

Background

An estimated 150,000 to 300,000 cases of nosocomial pneumonia occur each year in US hospitals. The primary risk factor for nosocomial bacterial pneumonia is mechanical ventilation using an endotracheal tube. Ventilator-associated pneumonia (VAP) outcomes can be severe with mortality reaching 87%. VAP also extends length of stay by an average of 6 days and can cost >$40,000 per event. The scientific literature provides strong evidence of an association between oropharyngeal and dental plaque colonization and respiratory infection.

Objective

To determine the effectiveness of a comprehensive program of oral and dental health assessment and intervention to reduce the rates of VAP.

Subjects/Patients

All adult patients placed on mechanical ventilation using an endotracheal tube in the medical intensive care unit (MICU) during Jan 2002–Dec 2003 were included in the study.

Interventions

A new oral-dental care kit with universal adaptor was introduced that provided [1] a closed oral/tracheal suction system; [2] covered Yankauer to reduce environmental contamination; [3] catheters for suctioning secretions that pool in the mouth and oropharynx prior to accumulating above the endotracheal cuff (q6h); [4] suction toothbrush with hydrogen peroxide solution to reduce dental plaque (2x day); [5] suction oral swab with moisturizer to promote mucosal integrity (q4h).

Methods

Patients intubated between Jan-Dec 2002 (pre-intervention) received standard oral care. For the period of Jan-Dec 2003 (post-intervention), nurses were required to assess the daily condition of the lips, oral tissues, tongue, teeth, and saliva.

Results

Patient ages, sex, and diagnoses were similar in the pre-intervention group and the study group. The number of patients and ventilator days were 377 and 2,641 (avg. 7.0 days) for the pre-intervention group and 360 and 2,490 (avg. 6.9 days) for the patients using the new intervention. Risk for pneumonia in both years was high: ventilator utilization ratio (VUR) for the MICU in 2002 was 0.63 and 0.55 for 2003 or approximately 75th-90th percentile of NNIS data. Rate of VAP per 1000 ventilator days in the MICU was 7.6 in 2002 and 4.4 in 2003, a 42.1% reduction in the overall rate. NNIS benchmark data indicates median MICU VAP rates at 6.0 per 1000 ventilator days.

Conclusions

Careful assessment and improved oral care interventions to reduce bacterial colonization of the oropharynx and teeth reduces contaminated aspirates and subsequent VAP. This abstract describes and summarizes the results of a study that incorporated oral assessment protocols, oral and dental interventions to reduce bacterial colonization, and staff education to reduce the occurrence of VAP in medical intensive-care patients.

PubMed ID

Not Available.

VAP/Oral Care Connection

Colonization and infection in surgical intensive care patients–a prospective study.

Kerver AJ, Rommes JH, Mevissen-Verhage EA, Hulstaert PF, Vos A, Verhoef J, Wittebol P.
Intensive Care Med. 1987;13(5):347-51.

Background

Nosocomial infections are a major problem in intensive care patients.

Design

Prospective

Subjects/Patients

Thirty-nine patients, requiring intensive care for 5 days or more (mean 15.8 days) were prospectively investigated, to determine the relation between colonisation and nosocomial infection

Methods

Thrice weekly, cultures from the oropharynx, respiratory and digestive tract were obtained. Colonization with aerobic gram-negative microorganisms of the oropharynx, respiratory and digestive tract significantly increased during the stay in the Intensive Care Unit.

Results

In 29 patients (74%) 78 nosocomial infections were diagnosed. The most frequent nosocomial infections were pneumonia (26 patients, 66.6%), catheter-related bacteraemia (11 patients, 28.2%), and wound infections (7 patients, 17.9%). In 59 instances (75.6%), colonization with the same potential pathogenic microorganism preceded the nosocomial infection. The overall mortality was 25.6% (10 patients), bacteraemia with aerobic gram-negative microorganisms being the cause of death in 7 patients.

PubMed ID

3655100

VAP/Oral Care Connection

Oral care reduces incidence of ventilator-associated pneumonia in ICU populations.

Mori H, Hirasawa H, Oda S, Shiga H, Matsuda K, Nakamura M.
Intensive Care Med. 2006 Feb;32(2):230-6. Epub 2006 Jan 25.

Objective

To examine whether oral care contributes to preventing ventilator-associated pneumonia (VAP) in ICU patients.

Design

Nonrandomized trial with historical controls.

Subjects/Patients

A medical-surgical ICU in a university hospital. 1,666 mechanically ventilated patients admitted to the ICU.

Methods

Oral care was provided to 1,252 patients who were admitted to the ICU during period between January 1997 and December 2002 (oral care group), while 414 patients who were admitted to the ICU during period between January 1995 and December 1996 and who did not receive oral care served as historical controls (non-oral care group).

Results

Incidence of VAP(episodes of pneumonia per 1000 ventilator days) in the oral care group was significantly lower than that in the non-oral care group (3.9 vs 10.4). The relative risk of VAP in the oral care group compared to that in the non-oral care group was 0.37, with an attributable risk of -3.96%. Furthermore, length of stay in ICU before onset of VAP was greater in the oral care than in the non-oral care group (8.5+/-4.6 vs 6.3+/-7.5 days). However, no significant difference was observed in either duration of mechanical ventilation or length of stay between the groups (5.9+/-10.8 vs 6.0+/-8.8 days and 7.5+/-11.5 vs 7.2+/-9.5 days, respectively). Pseudomonoas aeruginosa was the most frequently detected bacteria in both groups. Number of potentially pathogenic bacteria in oral cavity was significantly reduced by single oral care procedure.

Conclusions

Oral care decreased the incidence of VAP in ICU patients.

PubMed ID

16435104

VAP/Oral Care Connection

Oral health and care in the intensive care unit: state of the science.

Munro CL, Grap MJ.
Am J Crit Care. 2004 Jan;13(1):25-33; discussion 34.

Background Oral health is influenced by oral microbial flora, which are concentrated in dental plaque. Dental plaque provides a micro habitat for organisms and an opportunity for adherence of the organisms to either the tooth surface or other microorganisms. In critically ill patients, potential pathogens can be cultured from the oral cavity. These microorganisms in the mouth can translocate and colonize the lung, resulting in ventilator-associated pneumonia.

Objective To describe oral health in critically ill patients, review existing research on the relationship of oral health to nosocomial pneumonia in the ICU, and discuss the state of the science of oral care interventions in ICU patients.

Design Literature review

Conclusions The importance of oral care in the intensive care unit has been noted in the literature, but little research is available on mechanical or pharmacological approaches to reducing oral microbial flora via oral care in critically ill adults. Most research in oral care has been directed toward patients' comfort; the microbiological and physiological effects of tooth brushing in the intensive care unit have not been reported. Although 2 studies indicated reductions in rates of ventilator-associated pneumonia in cardiac surgery patients who received chlorhexidine before intubation and postoperatively, the effects of chlorhexidine in reducing ventilator-associated pneumonia in other populations of critically ill patients or its effect when treatment with the agent initiated after intubation have not been reported. In addition, no evaluation of the effectiveness of pharmacological and mechanical interventions relative to each other or in combination has been published. Additional studies are needed to develop and test best practices for oral care in critically ill patients.

PubMed ID 14735645

VAP/Oral Care Connection

Oral health status and development of ventilator-associated pneumonia: a descriptive study.

Munro CL, Grap MJ, Elswick RK Jr, McKinney J, Sessler CN, Hummel RS 3rd.
Am J Crit Care. 2006 Sep;15(5):453-60.

Objective

To describe the relationship between ventilator-associated pneumonia and oral health status, changes in oral health status during the first 7 days after intubation, and microbial colonization of the oropharynx and trachea.

Background

Ventilator-associated pneumonia is a significant cause of morbidity and mortality and may be influenced by oral health.

Subjects/Patients

A total of 66 patients were enrolled within 24 hours of intubation and were followed up for up to 7 days.

Methods

Data on oral health measures and the Clinical Pulmonary Infection Score (CPIS) were collected at baseline, day 4 (n = 37), and day 7 (n = 21). A regression model was used to predict risk of pneumonia at day 4.

Results

Dental plaque and oral organisms increased over time. Correlations were significant for baseline and day 4 dental plaque ($P < .001$), baseline salivary lactoferrin and day 4 plaque $P = .01$), and lower salivary volume and higher day 4 CPIS ($P = .02$). Potential pathogens were identified in oral cultures for 6 patients before or at the same time as the appearance of the organisms in tracheal aspirates. Correlations were significant with day 4 CPIS for score on the Acute Physiology and Chronic Health Evaluation (APACHE) II ($P = .007$), day 4 salivary volume ($P = .02$), interaction of APACHE II score and day 1 CPIS ($P<.001$), and interaction of day 1 CPIS and plaque ($P=.01$).

Conclusions

Higher dental plaque scores confer greater risk for ventilator-associated pneumonia, particularly for patients with greater severity of illness. Salivary volume and lactoferrin may affect the risk.

PubMed ID

16926366

VAP/Oral Care Connection

Ventilator-asociated pneumonia improvement program.

Murray T, Goodyear-Bruch C.
AACN Adv Crit Care. 2007 Apr-Jun;18(2):190-199.

Background/ Rationale

Ventilator-associated pneumonia (VAP) is a significant clinical problem associated with increased intensive care unit and hospital length of stay and substantial increases in delivery cost and associated morbidity and mortality.

Methods

Steps necessary to reduce VAP were identified and put into place in all the intensive care units. Patient positioning, oral care, nutrition, and management of comfort drugs are a few of the processes addressed to reduce VAP.

Results

With system changes and management of the environment of care, the incidence of VAP was reduced in seven of our intensive care units across the system.

Conclusions

Standardization of these essential care practices can reduce the incidence of this nosocomial infection and its associated increases in the cost of care delivery and mortality.

PubMed ID

17473548

CHG

Chlorhexidine gluconate 0.12% oral rinse reduces the incidence of total nosocomial respiratory infection and nonprophylactic systemic antibiotic use in patients undergoing heart surgery.

DeRiso AJ 2nd, Ladowski JS, Dillon TA, Justice JW, Peterson, AC. *Chest.* 1996 Jun;109(6):1556-61.

Objective

The purpose of this study was to test the effectiveness of oropharyngeal decontamination on nosocomial infections in a comparatively homogeneous population of patients undergoing heart surgery.

Design

This was a prospective, randomized, double-blind, placebo-controlled clinical trial. Experimental and control groups were selected for similar infection risk parameters.

Setting/Data Source

Cardiovascular ICU of a tertiary care hospital.

Subjects/Patients

Three hundred fifty-three consecutive patients undergoing coronary artery bypass grafting, valve, or other open heart surgical procedures were randomized to an experimental (n=173) or control (n=180) group. Heart and lung transplantations were excluded.

Interventions

The experimental drug chosen was 0.12% chlorhexidine gluconate (CHX) oral rinse.

Measurements and Results

The overall nosocomial infection rate was decreased in the CHX-treated patients by 65% (24/180 vs 8/173; $p<0.01$). We also noted a 69% reduction in the incidence of total respiratory tract infections in the CHX-treated group (17/180 vs 5/173; $p<0.05$). Gram-negative organisms were involved in significantly less ($p<0.05$) of the nosocomial infections and total respiratory tract infections by 59% and 67%, respectively. No change in bacterial antibiotic resistance patterns in either group was observed. The use of nonprophylactic IV antibiotics was lowered by 43% (42/180 vs 23/173; $p<0.05$). A reduction in mortality in the CHX-treated group was also noted (1.16% vs 5.56%).

Conclusions

Inexpensive and easily applied oropharyngeal decontamination with CHX oral rinse reduces the total nosocomial respiratory infection rate and the use of nonprophylactic systemic antibiotics in patients undergoing heart surgery. This results in significant cost savings for those patients who avoid additional antibiotic treatment.

PubMed ID

8769511

CHG

Effect of gingival and dental plaque antiseptic decontamination on nosocomial infections acquired in eh intensive care unit: a double-blind placebo-controlled multicenter study.

Fourrier F, Dubois D, Pronnier P, Herbecq P, Leroy O, Desmettre T, Pottier-Cau E, Boutiqny H, Di Pompeo C, Durocher A, Roussel-Delvallez M, PIRAD Study Group.
Journal Critical Care Med. 2005 Aug;33(8):1728-1735.

Objective

To document the effect of gingival and dental plaque antiseptic decontamination on the rate of nosocomial bacteremias and respiratory infections acquired in the intensive care unit (ICU).

Design

Prospective, multicenter, double-blind, placebo-controlled efficacy study.

Subjects/Patients

Six ICUs: three in university hospitals and three in general hospitals. A total of 228 nonedentulous patients requiring endotracheal intubation and mechanical ventilation, with an anticipated length of stay > or =5 days.

Methods

Antiseptic decontamination of gingival and dental plaque with a 0.2% chlorhexidine gel or a placebo gel, three times a day, during the entire ICU stay.

Results

Demographic and clinical characteristics, organ function data (Logistic Organ Dysfunction score), severity of condition (Simplified Acute Physiologic Score), and dental plaque status were assessed at baseline and until 28 days. Bacteriologic sampling of dental plaque and saliva was done every 5 days, and blood, tracheal aspirate, and bronchoalveolar lavage cultures were performed when appropriate. The primary efficacy end point was the incidence of bacteremia, bronchitis, and ventilator-associated pneumonia, expressed as a percentage and per 1000 ICU days. All baseline characteristics were similar between the treated and the placebo groups. The incidence of nosocomial infections was 17.5% (13.2 per 1000 ICU days) in the placebo group and 18.4% (13.3 per 1000 ICU days) in the plaque antiseptic decontamination group (not significant). No difference was observed in the incidence of ventilator-associated pneumonia per ventilator or intubation days, mortality, length of stay, and care loads (secondary end points). On day 10, the number of positive dental plaque cultures was significantly lower in the treated group (29% vs. 66%; $p < .05$). Highly resistant Pseudomonas, Acinetobacter, and Enterobacter species identified in late-onset ventilator-associated pneumonia and previously cultured from dental plaque were not eradicated by the antiseptic decontaminaion. No side effect was reported.

Conclusions

Gingival and dental plaque antiseptic decontamination significantly decreased the oropharyngeal colonization by aerobic pathogens in ventilated patients. However, its efficacy was insufficient to reduce the incidence of respiratory infections due to multiresistant bacteria.

PubMed ID

16096449

CHG

Duration of action of a single, early oral application of chlorhexidine on oral microbial flora in mechanically ventilated patients: a pilot study.

Grap MJ, Munro CL, Elswick RK Jr, Sessler CN, Ward KR.
Heart Lung. 2004 Mar-Apr;33(2):83-91.

Objective

The purpose of this study was to describe the effect of an early post-intubation oral application of chlorhexidine gluconate on oral microbial flora and ventilator-associated pneumonia.

Design

Random clinical trial

Subjects/Patients

Thirty-four intubated patients

Methods

Randomly assigned to chlorhexidine gluconate by spray or swab or to control group. Oral cultures were done at study admission, 12, 24, 48, and 72 hours, whereas the Clinical Pulmonary Infection Score (CPIS) was documented at study admission, 48, and 72 hours.

Results

Reductions in oral culture scores (less growth) were only found in the treatment groups (swab and spray); no reduction was found in the control group. There was a trend for fewer positive cultures in the combined treatment groups. The mean CPIS for the control group increased to a level indicating pneumonia (4.7 to 6.6), whereas the CPIS for the treatment group increased only slightly (5.17 to 5.57).

Conclusions

Trends in the data suggest that use of chlorhexidine gluconate in the early post-intubation period may mitigate or delay the development of ventilator-associated pneumonia.

PubMed ID

15024373

CHG

Effectiveness of 0.12% chlorhexidine gluconate oral rinse in reducing prevalence of nosocomial pneumonia in patients undergoing heart surgery.

Houston S, Hougland P, Anderson JJ, LaRocco M, Kennedy V, Gentry LO.
Am J Crit Care. 2002 Nov;11(6):567-70.

Background

Decreasing the levels of bacteria in the oropharynx should reduce the prevalence of nosocomial pneumonia.

Objective

To test the effectiveness of 0.12% chlorhexidine gluconate oral rinse in decreasing microbial colonization of the respiratory tract and nosocomial pneumonia in patients undergoing open heart surgery.

Design

A prospective, randomized, case-controlled clinical trial design

Subjects/Patients

A total of 561 patients undergoing aortocoronary bypass or valve surgery requiring cardiopulmonary bypass.

Methods

Peridex (0.12% chlorhexidine gluconate) was the experimental drug, and Listerine (phenolic mixture) was the control drug. A total of 561 patients undergoing aortocoronary bypass or valve surgery requiring cardiopulmonary bypass were randomized to an experimental (n = 270) or a control (n = 291) group. Nosocomial pneumonia was diagnosed by using the criteria established by the Centers for Disease Control and Prevention.

Results

The overall rate of nosocomial pneumonia was reduced by 52% (4/270 vs 9/291; P = .21) in the Peridex-treated patients. Among patients intubated for more than 24 hours who had cultures that showed microbial growth (all pneumonias occurred in this group), the pneumonia rate was reduced by 58% (4/19 vs 9/18; P = .06) in patients treated with Peridex. In patients at highest risk for pneumonia (intubated > 24 hours, with cultures showing the most growth), the rate was 71% lower in the Peridex group than in the Listerine group (2/10 vs 7/10; P = .02).

Conclusions

Although rates of nosocomial pneumonia were lower in patients treated with Peridex than in patients treated with Listerine, the difference was significant only in those patients intubated more than 24 hours who had the highest degree of bacterial colonization.

PubMed ID

12425407

CHG

Effect of oral decontamination with chlorhexidine on the incidence of nosocomial pneumonia: a meta-analysis.

Pineda LA.
Critical Care. 2006;1(1):1-8.

Objective

Nosocomial pneumonia is a significant cause of in-hospital morbidity and mortality. Oral care interventions have great potential to reduce the occurrence of nosocomial pneumonia. Studies using topical antiseptic agents yielded mixed results. We hypothesized that the use of chlorhexidine for oral decontamination would reduce the incidence of nosocomial pneumonia in patients requiring mechanical ventilation.

Design

This study is a meta-analysis of randomized controlled trials assessing the effect of chlorhexidine on the incidence of nosocomial pneumonia.

Subjects/Patients

Data sources were Medline, EMBASE, Cochrane library, citation review of relevant primary and review articles, and contact with expert informants. Out of 1,251 articles screened, 4 randomized, controlled trials were identified that included a total of 1,202 patients.

Methods

Descriptive and outcome data were extracted by two reviewers independently. Main outcome measures were the incidence of nosocomial pneumonia, and mortality. A random effects model was used.

Results

The incidence of nosocomial pneumonia in the control group was 7% (41 out of 615) compared to 4% (24 out of 587) in the treatment group. Gram-negative bacteria accounted for 78% of the total isolates, with Pseudomonas aeruginosa being the most frequently isolated pathogen irrespective of the intervention provided. Duration of mechanical ventilation and intensive care unit length of stay were comparable between the two groups. Overall, the use of oral decontamination with chlorhexidine did not affect the incidence of nosocomial pneumonia (odds ratio of 0.42; 95% confidence interval 0.16-1.06) or the mortality rate (odds ratio 0.77, 95% confidence interval 0.28-2.11).

Conclusions

The use of oral decontamination with chlorhexidine did not result in significant reduction in the incidence of nosocomial pneumonia in patients who received mechanical ventilation, nor altered the mortality rate. The lack of benefit may reflect the few studies conducted in this area. Future trials should focus on a combination strategy of mechanical and pharmacological interventions.

PubMed ID

16507165

Cleanliness of Suctioning Equipment

Bacterial growth in secretions and on suctioning equipment of orally intubated patients: a pilot study.

Sole ML, Poalillo FE, Byers JF, Ludy JE.
Am J Crit Care. 2002 Mar;11(2):141-9.

Background/ Rationale

Contamination of equipment, colonization of the oropharynx, and microaspiration of secretions are causative factors for ventilator-associated pneumonia. Suctioning and airway management practices may influence the development of ventilator-associated pneumonia.

Objective

To identify pathogens associated with ventilator-associated pneumonia in oral and endotracheal aspirates and to evaluate bacterial growth on oral and endotracheal suctioning equipment.

Methods

Specimens were collected from 20 subjects who were orally intubated for at least 24 hours and required mechanical ventilation. At baseline, oral and sputum specimens were obtained for culturing, and suctioning equipment was changed. Specimens from the mouth, sputum, and equipment for culturing were obtained at 24 hours (n=18) and 48 hours (n=10).

Results

After 24 hours, all subjects had potential pathogens in the mouth, and 67% had sputum cultures positive for pathogens. Suctioning devices were colonized with many of the same pathogens that were present in the mouth. Nearly all (94%) of tonsil suction devices were colonized within 24 hours. Most potential pathogens were gram-positive bacteria. Gram-negative bacteria and antibiotic-resistant organisms were also present in several samples.

Conclusions

The presence of pathogens in oral and sputum specimens in most patients supports the notion that microaspiration of secretions occurs. Colonization is a risk factor for ventilator-associated pneumonia. The equipment used for oral and endotracheal suctioning becomes colonized with potential pathogens within 24 hours. It is not known if reusable oral suction equipment contributes to colonization; how ever, because many bacteria are exogenous to patients' normal flora, equipment may be a source of cross-contamination.

PubMed ID

11888126

International References

Beyond comfort: oral hygiene as a critical nursing activity in the intensive care unit.

Berry AM, Davidson PM.
Intensive Crit Care Nurs. 2006 Dec;22(6):318-28.

Background

The role of oral hygiene in maintaining the health and well being of patients in the intensive care unit (ICU) is indisputable. This importance is not reflected in the body of research related to ICU practice. While a number of studies have examined oral hygiene practices in oncological patients there is significantly less attention devoted to these practices in the critically ill.

Objective

This paper has two discrete yet interrelated aims. Firstly, in relation to current available evidence and based on a sound knowledge of oral physiology, identify barriers to effective oral hygiene and subsequent effectiveness of the most commonly used and recommended methods of providing oral hygiene in the critically ill population. Secondly, informed by the critical review, identify recommendations for practice and future intervention studies.

Findings

To date, there is no definitive evidence to determine the most appropriate method of oral hygiene including the use of beneficial mouth rinses. Barriers identified in this review to providing optimal hygiene include: (1) mechanical barriers and equipment issues, (2) perceptions of the importance of mouth care and empathy with patient discomfort by nurses, (3) altered patient sensory perception and discomfort and (4) difficulties in patient communication. In spite of these challenges opportunities for collaborative research and increasing expertise in nurse researchers creates a climate to derive solutions to these factors.

Conclusions

It is clearly evident from this review of oral hygiene practices in intensive care that the need for ongoing research is of paramount importance. ICU nurses undeniably require rigorous research studies in order to inform their practice in the provision of oral hygiene for critically ill patients.

PubMed ID

16806933

International References

Oral decontamination with chlorhexidine reduces the incidence of ventilator-associated pneumonia.

Koeman M, Van der Ven AJ, Hak E, Joore HC, Kaasjager K, de Smet AG, Ramsay G, Dormans TP, Aarts LP, de Bel EE, Hustinx WN, van der Tweel I, Hoepelman AM, Bonten MJ.
Am J Respir Crit Care Med. 2006 Jun 15;173(12):1348-55.

Rationale

Ventilator-associated pneumonia (VAP) is the most frequently occurring nosocomial infection associated with increased morbidity and mortality. Although oral decontamination with antibiotics reduces incidences of VAP, it is not recommended because of potential selection of antibiotic-resistant pathogens. We hypothesized that oral decontamination with either chlorhexidine (CHX, 2%) or CHX/colistin (CHX/COL, 2%/2%) would reduce and postpone development of VAP, and oral and endotracheal colonization. OBJECTIVES: To determine the effect of oral decontamination with CHX or CHX/COL on VAP incidence and time to development of VAP.

Methods

Consecutive patients needing mechanical ventilation for 48 h or more were enrolled in a randomized, double-blind, placebo-controlled trial with three arms: CHX, CHX/COL, and placebo (PLAC). Trial medication was applied every 6 h into the buccal cavity. Oropharyngeal swabs were obtained daily and quantitatively analyzed for gram-positive and gram-negative microorganisms. Endotracheal colonization was monitored twice weekly.

Results

Of 385 patients included, 130 received PLAC, 127 CHX and 128 CHX/COL. Baseline characteristics were comparable. The daily risk of VAP was reduced in both treatment groups compared with PLAC: 65% (hazard ratio [HR]=0.352; 95% confidence interval [CI], 0.160, 0. 791; p=0.012) for CHX and 55% (HR=0.454; 95% CI, 0.224, 0. 925; p=0.030) for CHX/COL. CHX/COL provided significant reduction in oropharyngeal colonization with both gram-negative and gram-positive microorganisms, whereas CHX mostly affected gram-positive microorganisms. Endotracheal colonization was reduced for CHX/COL patients and to a lesser extent for CHX patients. No differences in duration of mechanical ventilation, intensive care unit stay, or intensive care unit survival could be demonstrated.

Conclusions

Topical oral decontamination with CHX or CHX/COL reduces the incidence of VAP.

PubMed ID

16603609

International References

Oral care practices in intensive care units: a survey of 59 European ICUs.

Rello J, Koulenti D, Blot S, Sierra R, Diaz E, De Waele JJ, Macor A, Agbaht K, Rodriguez A.
Intensive Care Med. 2007 Jun;33(6):1066-70.

Objective

To explore the type and frequency of oral care practices in European ICUs and the attitudes, beliefs, and knowledge of health care workers.

Design

An anonymous questionnaire was distributed to representatives of European ICUs. Results were obtained from 59 ICUs (one questionnaire per ICU) in seven countries 91% of respondents were registered nurses.

Measurements/ Results

Of the respondents 77% reported that they had received adequate training on providing oral care; most (93%) also expressed the desire to learn more about oral care. Oral care was perceived to be high priority in mechanically ventilated patients (88%). Cleaning the oral cavity was considered difficult by 68%, and unpleasant as well as difficult by 32%. In 37% of cases respondents felt that despite their efforts oral health worsens over time in intubated patients. Oral care practices are carried out once daily (20%), twice (31%) or three times (37%). Oral care consists principally of mouth washes (88%), mostly performed with chlorhexidine (61%). Foam swabs (22%) and moisture agents (42%) are used less frequently as well as manual toothbrushes (41%) although the literature indicates that these are more effective for thorough cleaning of the oral cavity. Electric toothbrushes were never used.

Conclusions

In European ICUs oral care is considered very important. It is experienced as a task that is difficult to perform, and that does not necessarily succeed in ensuring oral health in patients with prolonged intubation. Oral care consists primarily of mouth washes. The use of toothbrushes should be given more attention.

PubMed ID

17384927

International References

Oral decontamination is cost-saving in the prevention of ventilator-associated pneumonia in intensive care units.

Van Nieuwenhoven CA, Buskens E, Bergmans DC, van Tiel FH, Ramsay G, Bonten MJ.
Crit Care Med. 2004 Jan;32(1):126-30. Links

Objective

Although the development of ventilator-associated pneumonia (VAP) is assumed to increase costs of intensive care unit stay, it is unknown whether prevention of VAP by means of oropharyngeal decontamination is cost-effective. Because of wide ranges of individual patient costs, crude cost comparisons did not show significant cost reductions.

Design

Based on actual cost data of 181 individual patients included in a former randomized clinical trial, cost-effectiveness of prevention of VAP was determined using a decision model and univariate sensitivity analyses, and bootstrapping was used to assess the impact of variability in the various outcomes.

Data Source

Published data on prevention of VAP by oropharyngeal decontamination, which resulted in a relative risk for VAP of 0.45, with a baseline rate of VAP of 29% among control patients. The mean costs of the intervention were 351 dollars per patient (32 dollars per patient per day). All other costs were derived from the hospital administrative database for all individual patients.

Results of Base-Case Analysis

Prevention of VAP led to mean total costs of 16,119 dollars and 18,268 dollars for patients without preventive measures administered. Thus, costs were saved and instances of VAP were prevented. Similar results were observed in terms of overall survival.

Results of Sensitivity Analysis

Prevention of VAP remains cost-saving if the relative risk for VAP because of intervention is <0.923, the costs of the intervention are less than 2,500 dollars, and the prevalence of VAP without intervention is >4%. Bootstrapping confirmed that, with about 80% certainty, oropharyngeal decontamination results in prevention of VAP and simultaneously saves costs. In terms of a survival benefit, the results are less evident; the results indicate that with only about 60% certainty can we confirm that oropharyngeal decontamination would result in a survival benefit and simultaneously save costs.

Conclusions

This study provides strong evidence that prevention of VAP by means of oropharyngeal decontamination is cost-effective.

PubMed ID

14707570

International References

ORAL CARE IS CRITICAL CARE: The Role of Comprehensive Oral Care in the Prevention of Hospital Hospital-Acquired Pneumonia

Suzanne Pear, RN, Ph.D, CIC
Infection Control Today **11(10):44-48+.**
Online: www.iceinstitute.com.

Background

Hospital-acquired pneumonia (HAP) is the second most frequent healthcare-associated infection occurring to patients hospitalized in acute-care facilities. Being on a mechanical ventilator places patients at greatest risk for developing this lung infection (ventilator-associated pneumonia-VAP) as well as doubling their likelihood of death while in the hospital. Comprehensive oral care, along with other patient care interventions in the VAP prevention bundle, has been identified as significantly protecting patients from developing this lethal complication.

Methods

This educational program reviews the risk factors and consequences of HAP and VAP; identifies the Pathway to Pneumonia in the hospitalized patient; describes the role of the oral environment in the development of HAP/VAP and reviews recommended oral care interventions and studies which examine the current state of oral care practice in an effort to make clinicians aware of the importance of oral care/oral hygiene in the prevention of HAP/VAP.

Conclusions

Although not all of the evidence-based HAP/VAP prevention guidelines recommend the same strategies, one intervention that has been recognized as a core or adjunct component of a pneumonia prevention program is comprehensive oral care/oral hygiene. This direct connection between the reliable provision of comprehensive oral care and HAP/VAP prevention is evident.

PubMed ID

Not Available.

Notes

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