Oral Hygiene Practices in Critically Ill Patient Requiring Endotracheal Intubation and Mechanical Ventilation

Abstract

Background: Optimal oral hygiene for critically ill patient on mechanical ventilation is essential. The need of endotracheal intubation and mechanical ventilation increases the risk of ventilator associated pneumonia. Various strategies are practices to prevent such ill effects. However, the interventions of oral care for prevention of ventilator associated pneumonia has been variously described. We aimed to review the literature for best practices for drugs used to maintain oral hygiene in critically ill patient.

Methods: Studies were searched through PubMed through the years 2006 to 2016. The eligible studies were those comparing the different oral care regimes including use of tooth brush and comparison of chlorhexidine solution with povidine iodine.

Results: Seventeen studies were included comprising 5592 patients, whereby 11trials investigated the effects of chlorhexidine with/without tooth brushing and 4 trials compared the effects of intervention in oral care vs no intervention in the patients. Overall, interventions of oral care which included chlorhexidine were found to reduce the incidence of ventilator associated pneumonia while povidine iodine and potassium permanganate were not found to be useful.

Conclusion: An oral care regime inclusive of chlorhexidine should be incorporated to reduce the incidence of ventilator associated pneumonia occurring in mechanically ventilated patients.

Keywords: Oral hygiene; VAP; Chlorhexidine; Povidine iodine; Infection

Introduction

Oral hygiene is an important part of the daily care regime for the critically ill patients admitted in intensive care unit (ICU). The critically ill patients may require ventilator support due to their medical condition, surgery or trauma. Oral health appeared to deteriorate during hospitalization, especially in tracheally intubated patients. Changes include an increase in dental plaque accumulation [1]. Ventilator associated pneumonia (VAP) is defined as pneumonia that occurs 48-72 hrs after endotracheal intubation, characterized by presence of new or progressive infiltrates, signs of systemic infection (fever, altered white blood cell count), changes in sputum characteristics and detection of causative agent [1]. VAP has been observed in 9-27 % of patients who are on mechanical ventilation [1]. It remains a major cause of morbidity related to nosocomial infection in the ICU [2,3].

The important mechanism related to occurrence of VAP in mechanically ventilated patient is microaspiration of the oral flora (colonised oropharyngeal secretions) into the lower respiratory tract along the endotracheal tube [4]. Oral bacterial colonisation results from poor oral hygiene and collection of tissue debris in the oral cavity. Saliva has an antimicrobial, lubricating, and buffering properties. Its optimal secretion and flow maintains the oral hygiene and prevents colonisation of pathogenic microbial flora. In tracheally intubated patients, however, these natural defence mechanisms are hampered. Therefore, reduction in the oral microorganisms and following an oral care regime is essential to minimise the incidence of VAP. The literature describes array of strategies to maintain oral hygiene. This review aimed to suggest the appropriate oral hygiene technique for prevention of ventilator associated pneumonia.

Methods

Search strategy

This systemic search for the relevant studies was from the database PubMed during last 10 years. We searched using the key words “oral care in ICU”, “oral care in mechanically ventilated patients”, “oral care”, “oral care in intubated patients”, “chlorhexidiene”, “povidone iodine”, “normal saline” or “listeriene” in various combinations. The bibliography of the studies was scanned and any missing relevant studies was searched manually.

Data extraction

The data was extracted regarding the first author, year of publication, interventions done in the study, the control group and the outcome.

Results

The search included 17 studies, published from the year 2006 to 2016 whereby patients received oral care interventions
including tooth brushing with/without use of chlorhexidiene/ povidone iodine/normal saline or listerine (Table 1) [5-21]. Out of these 4 studies investigated the effect of no intervention in oral care as control with a specific intervention tooth brushing and/or use of chlorhexidine. Overall 7 studies including 2082 patients investigated chlorhexidine gluconate and found it as an effective oral rinse.

Table 1: Summary of literature review for oral hygiene in critically ill patients.

| Year          | No. of pts | Primary Condition                              | Inclusion Criteria                        | Type of Study          | Control Group                                      | Intervention Group                                      | Outcome                                                                 |
|---------------|------------|------------------------------------------------|-------------------------------------------|------------------------|----------------------------------------------------|----------------------------------------------------------|------------------------------------------------------------------------|
| Kim et al. [5]| 56         | Stroke patients                                | First ever stroke                        | No intervention        | Use of interdental brush and tongue cleaner        | Plaque index, gingival index & colonization index of candida albicans in saliva was less |
| Munro et al.  [6] | 249       | Critically ill patients                        | ICU patients without pneumonia           | Randomized controlled trial | No intervention                                    | 0.12% chlorhexidine (5mL twice a day) + tooth brushing/ tooth brushing/ chlorhexidine | Chlorhexidine reduced early VAP in pts                                |
| Pobo et al. [7]| 147       | Critically ill patients                        | Tracheally intubated for > 48hrs         | Randomized controlled trial | 0.12% chlorhexidine                               | 0.12% chlorhexidine + electric tooth brush                  | Addition of electric tooth brushing does not have any added benefit   |
| Ozaca et al. [8]| 61        | Critically ill patients                        | Scheduled for mechanical ventilation for atleast 48 hrs | Randomized controlled trial | Oral mucosa swabbing with saline                    | Oral mucosal swabbing with 0.1% chlorhexidine                | VAP was lesser in intervention group (6.8% vs 41.1%)                   |
| Seguin et al. [9]| 179      | Brain injury                                   | GCS<8 / cerebral haemorrhage, expected to remain intubated for next 24 hrs | Randomized controlled trial | Oral care with placebo                              | Oral care with povidone iodine                                | VAP developed in 24/78 in povidone group and 20/76 in placebo.         |
| Wannessa T [10]| 254       | Respiratory failure, shock, major surgery and compromised mental status | Critically ill admitted to ICU | Randomized controlled trial | Chlorhexidine 0.12%                               | Dental care programme by dental surg + usual care as in control | Respiratory infection incidence 8.7% interventional group and 18.1% control group |
| Berry et al. [11]| 398       | Patients mechanical ventilated                 | Patients mechanical ventilated            | Randomized controlled trial | Sterile water                                      | Listerine, Sodium bicarbonate                                | Microbial growth / inhibition Secondary – development of VAP Control – 4.3% Listerine 4.7% Sod bicarb 4.5% |
| Panchabhai et al. [12]| 471 | Critically ill patients                        | Randomized controlled trial              | 0.01% potassium Permanganate (pp) | 0.2% chlorhexidine gluconate | Development of VAP during ICU stay was lower with chlorhexidine as compared to pp. |                                                                 |
| Study Authors               | No. of Patients | Patient Description                                                                 | Study Type                | Intervention Details                                                                 | Main Findings                                                                                   |
|----------------------------|-----------------|--------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Scannapieco et al. [13]     | 115             | Patients admitted to trauma ICU                                                      | Randomized controlled trial | Placebo                                                                             | Topical 0.12% chlorhexidine gluconate reduced the number of Staphylococcus aureus but not the total number of enteric. No significant reduction in incidence of VAP |
| Sona et al. [14]            | 24              | Trauma, burns and post operative patients                                            | Observational study       | Preintervention                                                                      | Incidence of VAP pre intervention and post intervention were compared 46% reduction in VAP after intervention |
| Garcia et al. [15]          | 1538            | Respiratory failure and cardiovascular disease                                        | Preintervention            | Observation                                                                          | No difference in the incidence of VAP in patients in placebo and control group               |
| Rodrigues et al. [16]       | 194             | Patients admitted to ICU > 48 hrs                                                    | Placebo                   | 0.12% chlorhexidine                                                                  |                                                                                              |
| Koeman et al. [17]          | 385             | Adult patients needing mechanical ventilation > 48 hrs                                | Placebo                   | Chlorhexidine 2% or chlorhexidine 2% + colistin 2%                                    | Primary outcome - VAP 18% placebo, 10% Chlorhexidine and 13% combination group. Secondary outcome - endotracheal colonization, less in combination group. Use of Chlorhexidine / combination reduced oropharyngeal colonization |
| Tantipong et al. [18]       | 207             | Adult patients receiving mechanical ventilation in ICU and ward                      | Placebo (normal saline)   | 2% chlorhexidine                                                                    | Primary outcome - VAP 4.9% Chlorhexidine group 11.4% in placebo. Oral decontamination is safe and effective with Chlorhexidine to prevent VAP |
**Discussion**

Aspiration of oral secretions is one of the most important aetiology of ventilator associated pneumonia [4,7,12,22,23,24]. Contaminated secretions of oral cavity collect above the endotracheal tube cuff and which can trickle down the trachea to lung along the cuff. The oral microflora of a critically adult patients is different from healthy individuals. Within 48 hours, there is depletion of fibronectin which is responsible for maintenance of gram positive organisms which constitutes the normal flora of oral cavity [21]. The lack of oral hygiene practices can lead to deposition of dental plaque in 72 hours which is the potential nidus for growth of pathogenic microorganisms [16]. Saliva also has an antibacterial lysozyme. In critically ill patients and those who are on mechanical ventilation, drying of oral cavity occurs and this can add up to the risk.

The oral care practices aims to remove this microhabitat of the organisms and should include brushing of teeth, gums and tongue twice daily with a soft toothbrush. Moisturization of oral mucosa and lips every two to four hours also helps in maintaining oral flora [24]. Cursing of the oral mucosa with chlorhexidine gluconate has been found to be effective. The concentration most commonly used in the studies is 0.12%. Chlorhexidine reduces pellicle formation and bacterial adsorption and adhesion to the teeth surface [24]. Chlorhexidine being cationic attaches to the negatively charged bacterial membrane and penetrates the cell wall. At low concentrations, it acts as bacteriostatic by inhibiting membrane bound enzymes while at higher concentration, it acts as bactericidal by coagulating ATP and nucleic acids [24]. The analysis of the various trials also suggest that chlorhexidine is an effective oral hygiene care agent as it reduces the bacterial colonization and eliminates a risk factor in development of ventilator associated pneumonia. Thereby, every health care institute needs to develop an oral health care hygiene protocol in accordance with the local practices and guidelines.

**Conclusion**

We conclude from our analysis that oral hygiene practices should be protocolized in all cortical care units. It appears that chlorhexidine based decontamination would help in reducing the load of ventilator associated pneumonia.

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