

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 11 trials 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

Volume 7 Issue 1 - 2017

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Received: September 30, 2016 | **Published:** January 06, 2017

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”, “chlorhexidene”, “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 chlorhexidene/povidone iodine/normal saline or listeriene (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.

Discussion

Aspiration of oral secretions is one of the most important aetiology

of ventilator associated pneumonia.^{4,7,12,22-24} 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.

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 has 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 0.12% chlorhexidine	VAP was lesser in Intervention group (68.8% 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 povidine iodine	VAP developed in 24/78 in povidine group and 20/76 in placebo.
Wanessa 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	Randomized controlled trial	Sterile water	Listerine, Sodium bicarbonate	Microbial growth/inhibition Secondary – development of VAP Control -4.3 % Listerine- bicarb 4.7% Sod 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.
Scannapieco et al. ¹³	115		Patients admitted to trauma ICU	Randomized controlled trial	Placebo	Topical 0.12% chlorhexidine gluconate	chlorhexidine 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	SICU – requiring mechanical ventilation	Observational study	Preintervention	Post intervention Cleaning teeth with sodium monofluorophosphate 0.7% and rising with water and 0.12% chlorhexidine	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	>18 yr old admitted to ICU		Preintervention	Intervention	During intervention VAP reduced by 33 % VAP in study group-4.1% Control group – 8.6%
Rodrigues et al. ¹⁶	194		Patients admitted to ICU > 48 hrs		Placebo	0.12% chlorhexidine	No difference in the incidence of VAP in patients in placebo and control group
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

Table Continued...

Year	No. of pts	Primary Condition	Inclusion Criteria	Type of Study	Control Group	Intervention Group	Outcome
Tantipong et al. ¹⁸	207	Adult patients receiving mechanical ventilation in ICU and ward	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
Cabov et al. ¹⁹	60	Surgical ICU pts, minimum of 3 days stay			Mouth rinsing with bicarb followed by placebo gel	Application of 0.2% chx gel after mouth rinse with bicarb(30)	8/30 in placebo (26.7%) and 2/30 in Chlorhexidine (6.7%) developed VAP. Patient in treated group had lower ICU stay
Nicolosi et al. ²⁰	300	Patients scheduled for sternotomy			No oral decontamination	Oral decontamination group with 0.12% chlorhexidine	2.7% developed VAP in chlorhexidine group and 8.7% in no intervention group.
Segers et al. ²¹	954	Adults undergoing elective cardiovascular surgery			Oropharyngeal rinse with placebo	Oropharyngeal rinse with chlorhexidine 0.12 %	Incidence of nosocomial infection was less in chlorhexidine group (19.8% vs Placebo 26.2%)

The oral care practises 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 Cleansing 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.

Conflicts of interest

There is no conflict of interest.

Acknowledgements

None.

Funding

None.

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