



## The Effectiveness Of *Toothbrushing* Using Chlorhexidine Gluconate 0.2% On Ventilator Associated Pneumonia (Vap)

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### ABSTRACT

**Background:** Ventilator-Associated Pneumonia (VAP) can cause the patient's length of stay in the ICU to be prolonged and can cause infection so that if not treated, it can cause sepsis in patients who can eventually lead to death. Toothbrushing with the right frequency for patients, namely toothbrushing using 0.2% Chlorhexidine Gluconate liquid 2 times a day or 3 times a day, especially for intubated individuals, is essential to prevent the occurrence of Ventilator-Associated Pneumonia. The purpose of this study was to determine the difference in the effectiveness of *toothbrushing* using 0.2% *chlorhexidine gluconate*, three times a day and twice a day on the incidence of *Ventilator-Associated Pneumonia*.

**Methods:** This study is quantitative research with a descriptive approach with a quasi-experimental method with a post-test only non-equivalent control group design. The sampling technique used purposive sampling, with a total sample of 16 patients who were toothbrushed twice a day and 16 patients who were toothbrushed 3 times a day. The instrument used to assess VAP incidence was an observation sheet consisting of a *Clinical Pulmonary Infection Score* measurement result sheet.

**Results:** The results showed that the effectiveness of tooth brushing using *chlorhexidine gluconate* 0.2% with a frequency of 2 times a day was 81.3%, and a frequency of 3 times a day was 75%. Data analysis using *chi-square* showed *p-value* = 0.500.

**Conclusion:** there is no difference between the effectiveness of *toothbrushing* using 0.2% *chlorhexidine gluconate* with a frequency of 2 times a day or 3 times a day. It is recommended that ICU nurses perform toothbrushing using 0.2% *chlorhexidine gluconate* fluid routinely, either 2 times a day or 3 times a day in patients on a ventilator.

Keyword : Toothbrushing; Chlorhexidine Gluconate; Ventilator Associated Pneumonia

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**Background.** Mechanical ventilators are negative or positive pressure breathing devices that can maintain ventilation and oxygen delivery for a long time (Smeltzer & Bare, 2002). Mechanical ventilation is required in various conditions associated with inadequate ventilation, gas exchange, airway, structural changes in the chest cavity, and even reduced metabolic demands (Morton & Fontaine, 2009).

Ventilator-associated pneumonia (VAP) is a nosocomial infection that usually occurs in the intensive care unit and occurs after 48 hours of ventilator use (Elliot et al, 2007). VAP is a subgroup of *Hospital-Acquired Pneumonia* (HAP) which refers to the development of pneumonia on mechanical ventilation. There is an excellent potential for developing

pneumonia after insertion of an artificial airway, as tube bypass can interfere with many of the standard defence mechanisms in the lung (Urden, Stacy & Lough, 2008).

Ventilator-associated pneumonia (VAP) is a significant source of morbidity and mortality in the Intensive Care Unit (ICU) (Hingston et al., 2010). VAP can cause an extended stay in the ICU, which can lead to infection. Thus, if left untreated, it can lead to sepsis in the patient, eventually resulting in death (Liao

et al., 2001). VAP occurs in 9-28% of patients on mechanical ventilation with a mortality rate of 24-70%. (Eggimann et al., 2003). Ventilator-associated pneumonia was the most common nosocomial infection, at 41%, followed by central venous catheters at

30%, and urinary tract infections at 29%. The incidence of VAP increases with the increasing duration of mechanical ventilation. The estimated incidence is 3% per day for the first 5 days, 2% per day for 6-10 days, and 1% per day after 10 days (Rello J. et al, 2013).

Using a mechanical ventilator that is not supported by good and appropriate care can cause colonization of microorganisms in the oropharynx by potentially pathogenic flora, including staphylococcus aureus or streptococcus pneumoniae can cause infection in the use of mechanical ventilators, namely VAP (Hunter, 2006). The primary mechanism in the pathogenesis of VAP is through aspiration of pathogenic gram-positive and gram-negative bacteria that colonize the oropharynx and gastrointestinal tract. Changes in the normal oral flora in the first 48 hours and after that in critically ill patients from predominantly Streptococci to potentially pathogenic microbes are thought to have contributed to VAP incidence.

Proper oral care of patients, especially for intubated individuals, is essential. The American Association for Critical Care Nurses (AACN) recommends proper oral care using swabbing, brushing, and suctioning oral secretions. Brushing teeth is one of the protocols in the care of patients on a ventilator because it helps remove plaque and other debris from the tooth surface (American Dental Association, 2005; Berry et al., 2007). Cleaning dental plaque is more effective using a toothbrush than foam swabs (Pearson, 2006).

The use of antiseptics in *oral care* or oral hygiene in patients who are on mechanical ventilators can be done with chlorhexidine gluconate. Chlorhexidine is a disquamide derivative that is usually used in the form of gluconate. Based on research conducted by Koeman et al. (2006), data shows that chlorhexidine can significantly reduce the colonization of oropharyngeal microorganisms, both gram-positive and gram-negative, whereas chlorhexidine has more effect on gram-positive microorganisms. It is explained that the use of chlorhexidine from several

studies effectively prevented the occurrence of VAP.

Several journal explanations explain a decrease in the incidence of VAP in patients who received oral care using the toothbrushing technique using chlorhexidine gluconate three times a day. However, several journals explained that oral care with toothbrushing techniques using chlorhexidine gluconate could also increase the aspiration rate that triggers VAP if oral care is carried out too often.

According to Peterson (2005), to ensure good results in maintaining dental and oral hygiene in patients on mechanical ventilators, do oral hygiene twice a day by brushing correctly. Therefore, selecting the correct fluid and the technique and frequency of oral hygiene are needed to overcome oral infections and the risk of VAP incidence in patients with mechanical ventilation in the ICU.

Based on the description above, because no certainty explains the effectiveness of the frequency of oral hygiene, the researcher conducted research related to the differences in the effectiveness of toothbrushing using Chlorhexidine Gluconate which is done three times a day and twice a day on the incidence of Ventilator-Associated Pneumonia (VAP).

**Methods.** This study used a quantitative design with a descriptive approach. The study involved 32 respondents. 16 respondents were toothbrushed twice a day, and 16 patients were toothbrushed 3 times a day. The inclusion criteria in this study were patients attached to a mechanical ventilator < 48 hours, aged 18-60 years, normal blood (leukocyte) examination results, normal body temperature, the family in charge of the patient who represented the patient was willing to be a respondent. This study used chi square test.

The study was conducted at the Indramayu District Hospital and the MA Sentot Patrol Hospital Indramayu in December 2021. The room used in the study was the Intensive Care Unit (ICU). The instrument used was the Clinical Pulmonary Infection Score (CPIS).

In this study, an ethical test was carried out at the RSD Gunung Jati Cirebon. Description of

Ethical Approval No. 046/ LAIKETIK/ KEPKRSGJ/XII/2021.

**Results and Discussion.** Respondents in this study were 32 patients. The average age of respondents in this study was 48.91, and most medical diagnoses were Post Op Craniotomy 7 respondents (21.9%). The analysis results of the characteristics of the patient respondents found that most of the gender of the patient respondents were women by 53.1%. Most of the comorbidities that patients had were having no comorbidities or comorbidities of 71.9%.

In this study, most respondents were diagnosed with CKB and ischemic stroke, which makes the patient use a mechanical ventilator. The installation of a mechanical ventilator is also closely related to the presence of impaired respiratory function caused by drugs, disease, high intracranial pressure, or other conditions that cause the patient to be unable to breathe without the help of a machine (Dzulfikar, 2006).

*Oral hygiene* is one of the nursing interventions in patients who are on mechanical ventilators to maintain the patient's oral health and prevent infection and the risk of VAP. One form of *oral hygiene* is brushing or *toothbrushing*, which can help remove plaque and other debris from the tooth surface. When doing *toothbrushing*, you can use an antiseptic liquid to reduce the growth of bacteria in the oropharynx.

In this study, the antiseptic liquid used was 0.2% *Chlorhexidine Gluconate* (CHX). CHX has broad activity against gram-positive microorganisms, including multi-resistant pathogens such as *methicillin-resistant Staphylococcus aureus* (MRSA) and *vancomycin-resistant enterococci* (VRE) (Alicia, 2004). Based on research conducted by Koeman, Hak, Ramsay, Joore Kaasjager, Hans, and Van Der Ven (2006), it is found that *chlorhexidine* can significantly reduce the colonization of *oropharyngeal* microorganisms, both gram-positive and gram-negative. In contrast, chlorhexidine had more effect on gram-positive microorganisms. Although this solution has a side effect on tooth discoloration if used long term, the *Institute for Health Improvement* (IHI) still recommends this solution as an oral treatment in the VAP Bundle (Hua et al., 2016). A study comparing 0.9% NS fluid with 0.12% CHX showed a significant difference in the incidence of VAP (Moustafa &

Tantawey, 2016). This can happen because NS 0.9% only functions to help repair damaged oral mucosal tissue, not to prevent the development of VAP pathogens.

Based on the results of this study, it showed that *toothbrushing* using 0.2% *chlorhexidine gluconate* with a frequency of 2 times a day had a higher percentage of effectiveness, namely 81.3%. The results of this study are under the study of Zand et al. (2017); the intervention group with *toothbrushing* twice a day has a VAP incidence rate of 5.3%, while the control group was 22.8%. So, there is a significant difference in VAP incidence in the two groups ( $p$ -value = 0.007).

Meanwhile, *toothbrushing* using 0.2% *chlorhexidine liquid* three times a day in this study had an effectiveness of 75%. This is in line with the research of Liao et al. (2014); there is a significant difference in the incidence of VAP between the control group and the intervention group ( $p$ -value = 0.004). In the intervention group: checking the cuff pressure every 8 hours and maintaining it at a pressure of 20-24 mmHg, performing oral assessments with *Barnason's Oral Assessment Guide* (OAG) every 8 hours, *oral care* for at least 5 minutes with 0.2% *Chlorhexidine gluconate* as much as 15 - 20 ml with a pediatric toothbrush, HOB maintained at 30°.

The comparison of the effectiveness of *Toothbrushing* using *Chlorhexidine Gluconate* 0.2% twice a day and three times a day in this study showed a  $p$ -value of 0.500. Thus, it can be concluded that there is no difference between the effectiveness of *toothbrushing* using *chlorhexidine gluconate* 0.2% twice a day and three times a day. So, to do *toothbrushing* in the ICU, nurses can do it 2 times a day or 3 times a day because they are equally effective in preventing VAP.

The frequency of *toothbrushing* in mechanically ventilated patients does vary. De Lacerda Vidal et al. (2012) recommend that oral care be carried out every 12 hours. Meanwhile, most researchers recommend every 8 hours (Lorente, 2012; Liao et al., 2014; Estaji, 2016; Berry, 2013; Pobo, 2009). Ames (2011) states that the frequency of oral care between patients varies, depending on the condition of their *oral health*. Therefore, the frequency of *oral care* is based on the *back oral assessment score* (BOAS), but it is given at least every 12 hours. In addition, there are

several essential protocols in oral care, namely the position of *Head of Bed* (HOB) 30°, checking the ETT cuff, and maintaining a pressure of 20-24 mmHg, as well as suction before and during *oral care*.

The most significant frequency in reducing VAP incidence was the adjusted frequency of the BOAS (*Beck Oral Assessment Scale*) results. The optimal frequency of *oral care* should be determined for each individual, taking into account the mouth's condition. The BOAS instrument consists of 5 indicators: the condition of the lips, gums and oral mucosa, teeth, tongue, and saliva. The final assessment was interpreted into 4 categories, namely a score of 1-5 (without dysfunction) with oral care every 12 hours, a score of 6-10 (mild dysfunction) receiving oral care every 8-12 hours, a score of 11-15 (moderate dysfunction) applying oral care every 8 hours, and for a score of 16-20 (severe dysfunction) should receive oral care every 4 hours (Miranda, 2016). BOAS has a significant effect on reducing the incidence of VAP. The frequency of oral care once or twice a day compared with the frequency of BOAS results, the incidence of VAP is less in the group of patients with BOAS results (Chacko et al., 2017; Haghghi et al., 2017).

Prevention of VAP incidents is not only influenced by oral care, but the VAP Bundle also contributes to it. The results showed that Bundle VAP activities that were carried out in addition to oral care were 30° head elevation, daily sedation, gastric ulcer prophylaxis, Tracheal Tube (TT) cuff monitoring, Endotracheal Cuff occlusive pressure regulation between 22-30 mmHg, changing the ventilator circuit once a week, and using a closed suction system. This is under the VAP bundle from the Institute for Health Improvement (IHI) combined with a bundle from the Centers for Disease Control and Prevention (CDC). Miranda (2016), in his research, showed that the VAP bundle was able to reduce the VAP rate, which was quite significant from 32 cases per 1,000 ventilators to only 12 cases after the intervention.

**Conclusion and Suggestions.** The analysis results of the characteristics of 32 respondents the mean age of respondents were 48.91 years with a standard deviation of

10.397 years. Most of the respondents were female by 53.1%. Most cases in this study were Post Op Craniotomy by 21.9%, while the comorbidities that most patients had were not having comorbidities of 71.9%.

The study results on the effectiveness of *toothbrushing* using 0.2% *chlorhexidine gluconate liquid* twice a day showed effectiveness of 81.3%, while those carried out 3 times a day were 75%.

After comparing the effectiveness of *toothbrushing* using 0.2% *chlorhexidine gluconate liquid* twice a day and three times a day, the *p-value* was 0.500. Thus, it can be concluded that there is no difference between the effectiveness of *toothbrushing* using *chlorhexidine gluconate* 0.2% twice a day and three times a day. So, to do *toothbrushing* in the ICU, nurses can do it 2 times a day or 3 times a day because they are equally effective in preventing VAP.

To find out the most significant frequency in reducing the incidence of VAP is the adjusted frequency from the results of the BOAS (*Beck Oral Assessment Scale*). The optimal frequency of oral care should be determined for each individual, taking into account the mouth's condition.

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