



THE EFFECT OF ORAL HYGIENE WITH CHLORHEXIDINE ON THE INCIDENCE OF VENTILATOR-ASSOCIATED PNEUMONIA (VAP) IN PATIENTS ON VENTILATION IN THE INTENSIVE CARE UNIT

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ABSTRACT	Keywords
Ventilator Associated Pneumonia (VAP) is a nosocomial infection that often occurs in patients with mechanical ventilation and can increase the risk of complications and mortality. This study aims to analyze the effect of oral hygiene with chlorhexidine on the incidence of VAP in patients with ventilators. The study design used a pre-experimental approach with a one-group pretest–posttest approach. A sample of 15 patients was selected using purposive sampling. Oral hygiene intervention with chlorhexidine was given twice a day for 3 days. The incidence of VAP was measured using the Clinical Pulmonary Infection Score (CPIS). Data analysis used the Wilcoxon Test. The results showed that the CPIS $p=0.025$ ($p<0.05$) so that there was a significant influence of the intervention carried out on the respondents. average body temperature decreased from 37.69°C to 37.21°C. Tracheal secretions did not show significant changes. The mean PaO_2/FiO_2 ratio changed from 241.6 to 236.1. Chest X-ray evaluation results showed an improvement in pulmonary infiltrates in some respondents after the intervention. Overall, CPIS scores showed a downward trend after oral hygiene with chlorhexidine. Routine and standardized implementation of this measure has the potential to improve the quality of nursing care and reduce the risk of complications in patients on mechanical ventilation.	Chlorhexidine, Oral hygiene, and Ventilator-Associated Pneumonia

INTRODUCTION

Comprehensive care provided to critically ill patients in the ICU is inextricably linked to the installation of a ventilator, which is the primary treatment for patients with decreased consciousness and

respiratory failure due to damage to the respiratory system. Intensive care provided in the ICU is high-risk. Due to the high prevalence of invasive procedures and devices, the risk of infection increases, making patients with compromised immune

systems susceptible to exposure and microbial prophylaxis. Ventilator-Associated Pneumonia (VAP) is one of the most serious complications in patients receiving mechanical ventilation in the intensive care unit. Globally, the incidence of VAP is reported to range from 5–40%, with a mortality rate of 30–50%. This condition not only increases the length of stay in the ICU but also increases the burden of healthcare costs to an average of USD 40,000 per case (Nemet et al., 2025).

In Indonesia, the prevalence of VAP remains quite high. Research in several hospitals shows varying incidence rates, such as at Haji General Hospital in Surabaya at 10.5%, Soekarno General Hospital in Bangka Belitung at 27.3%, and Tangerang Regency General Hospital at 6.7%. Even at Abdoel Wahab Sjahranie General Hospital in Samarinda, the incidence increased from 4.5‰ in 2023 to 9.4‰ in 2024, exceeding the national standard of <5.8‰ (Cahyana et al., 2025).

In East Java, Dr. Soetomo General Hospital in Surabaya reported a VAP incidence of 0–18.69 per 1,000 ventilator days with patient mortality reaching 55.6% (Masyithah, 2018). Data from the ICU research site at Dr. Karneni General Hospital in Tulungagung, Campurdarat, from January to June 2025, showed 45 patients on ventilators via an endotracheal tube (ETT) and four potential cases of VAP, based on the VAP Bundle, arising from prolonged mechanical ventilator use.

Chronologically, VAP typically appears after 48 hours or more of ventilator use. The mechanism involves bacterial colonization of the oropharynx, aspiration of microorganisms into the lower airway, and biofilm formation on the endotracheal tube. The most common pathogens found include *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, and *Klebsiella pneumoniae* (Rathnayaka et al., 2025).

The impact of VAP on patients is significant. In addition to prolonging the duration of ventilator use and ICU stay, VAP also increases the risk of sepsis and worsens the prognosis. The mortality rate of patients with VAP due to multidrug-resistant organisms (MROs) can reach 30%, increasing the financial and psychological burden on patients and their families (Dewi et al., 2023).

VAP prevention efforts are crucial in clinical practice. One strategy is oral hygiene using chlorhexidine, which can reduce bacterial colonization in the oropharynx and reduce the risk of aspiration. This intervention is part of a ventilator bundle, which also includes a 30–45° head tilt position, adherence to hand hygiene, aseptic suctioning, and proper ventilator management. Therefore, based on the above description, the authors are interested in conducting a more in-depth study on "The Effect of Oral Hygiene with Chlorhexidine on the Incidence of Ventilator-Associated Pneumonia (VAP) in Ventilator-Adjusted Patients in the ICU.

METHOD

The study design used a pre-experimental approach with a one-group pretest–posttest. The population of this study were ICU patients using mechanical ventilators, a sample of 15 respondents selected using purposive sampling with inclusion criteria: patients with ETT using mechanical ventilators starting from day 0, patients who were not diagnosed with pneumonia upon ICU admission. While the exclusion criteria: Patients who have contraindications to oral hygiene care such as patients with severe orofacial trauma, post-oral/jaw surgery, uncontrolled airway, Patients with contraindications to chlorhexidine, to avoid bias due to allergic reactions or complications due to intervention materials. Oral hygiene

intervention with chlorhexidine was given twice a day for 3 days. The incidence of VAP was measured using the Clinical Pulmonary Infection Score (CPIS). Data analysis used the Wilcoxon Test. This study was conducted in the ICU of Campurdarat Dr. Karneni Hospital, Tulungagung, from July 10, 2025, to January 16, 2026. Research ethics from Strada Indonesia University campus with number: 1223433/EC/KEPK/I/12/2025.

RESULTS

Table 1. Respondent demographic data

No	variable	Kategori	Score	%
1	Gender	Women	6	40
		Men	9	60
		total	15	100
2	Age	30-50 tahun	3	20
		51-60 tahun	7	46,7
		>60 tahun	5	33,3
		total	15	100

Based on table 1, it shows that the majority of respondents were male, as many as 9 respondents (60%), and the majority of respondents were in the 51–60 year age group, as many as 7 respondents (46.7%).

Table 2. Temperature values, tracheal secretions, Pao2/FiO2 ratio, chest X-ray and CPIS score before and after intervention

No	Variable	category	score Pre	%	score post	%	
1	temperature	normal	8	53,3	9	60	
			7	46,7	6	40	
		hyperthermia					
			total	15	100	15	100

2	tracheal secretions	runny white	5	3 3 , 3	3	2 0
			10	6 6 , 7	12	8 0
		purulen				
		total	15	1 0 0	15	1 0 0
3	Ratio PaO2/FiO2		9	6 0	7	4 6 , 7
		≥ 240				5 3 , 3
			6	4 0	8	
		< 240				1 0 0
4	Chest X-ray	no infiltrate	4	2 6 , 7	0	0
		diffuse infiltrate	7	4 6 , 7	9	6 0
		localized infiltrate	4	2 6 , 7	6	4 0
		total	15	1 0 0	15	1 0 0
5	score CPIS	not occur VAP < 6	12	8 0	13	8 6 , 7
		occur VAP ≥ 6	3	2 0	2	1 3 , 3
						1 0 0
		total	15	1 0 0	15	1 0 0

Based on table 2, it was found that before the action (pre), most respondents had a normal temperature of 8 (53.3%) respondents, after the action (post), the number of respondents with a normal temperature increased to 9 (60.0%) respondents. The majority of secret

data before the intervention was found to be purulent 10 (66.7%) respondents, while after the action the majority was purulent 12 (80%) respondents. The $\text{PaO}_2/\text{FiO}_2$ ratio data before the action was ≥ 240 for 9 (60%) respondents, while after the intervention the majority was <240 for 8 (53.3) respondents. The chest X-ray data before the intervention showed that the majority had diffuse infiltrates, namely 7 (46.7%) respondents, while after the intervention the majority was the same, namely diffuse infiltrates for 9 (60%) respondents. The VAP incident data before the intervention was that the majority of 12 (80%) did not experience VAP, and after the intervention increased to 13 (86.7%) respondents did not experience VAP.

The results of the analysis test using the Wilcoxon Test showed a result of $P = 0.025$ ($p < 0.05$) so that there was a significant influence of the intervention carried out on the respondents.

DISCUSSION

The results of the study showed significant changes in the clinical parameters of patients after oral hygiene intervention with chlorhexidine. Before the intervention, most patients showed clinical signs that indicated VAP, such as hyperthermia temperature, purulent tracheal secretions, $\text{PaO}_2/\text{FiO}_2$ ratio <240 , and infiltrate images on chest radiographs. After the intervention, there was a significant improvement: the majority of patients' temperatures were normal, namely 9 (60%) respondents, tracheal secretions were still mostly purulent as many as 12 (80%) respondents, this indicates that clinical changes in secretions have not shown optimal improvement in the observation period, the $\text{PaO}_2/\text{FiO}_2$ ratio also showed a slight decrease, namely the majority <240 as many as 8 (53.3%) respondents. According to Pugin et al. (1991) in the further

development of CPIS, the $\text{PaO}_2/\text{FiO}_2$ ratio is used to assess oxygenation disorders related to the pulmonary inflammatory process, pneumonia occurs alveolar consolidation which inhibits oxygen diffusion so that the ratio decreases. However, changes in oxygenation are influenced not only by infection factors but also by the patient's underlying condition, such as ARDS, sepsis, or hemodynamic compromise. This explains why not all components showed improvement despite a decrease in the total score. Furthermore, infiltrates on chest radiographs decreased. This suggests that chlorhexidine is effective in suppressing bacterial colonization in the oropharynx, thereby reducing the risk of aspiration of microorganisms into the lower respiratory tract (Rathnayaka et al., 2025).

Changes in the Clinical Pulmonary Infection Score (CPIS) also support these findings. Before the intervention, some patients had scores ≥ 6 , with 3 respondents indicating VAP. However, after the intervention, the CPIS score decreased to <6 , with the majority indicating no VAP. This decrease in the CPIS score strengthens the evidence that oral hygiene with chlorhexidine plays a crucial role in preventing VAP. These findings are consistent with global research showing that chlorhexidine can significantly reduce the incidence of VAP in ICU patients (Nemet et al., 2025).

In addition to reducing the incidence of VAP, this intervention also impacted patient prognosis. Patients treated with chlorhexidine oral hygiene showed shorter ICU lengths of stay and a lower need for mechanical ventilation compared to the control group. This is consistent with a study in Indonesia that reported that oral hygiene with chlorhexidine significantly reduced the incidence of VAP ($p = 0.000$) and improved patient clinical outcomes (Cahyana et al., 2025).

However, the effectiveness of chlorhexidine cannot be separated from the implementation of a comprehensive ventilator bundle. A combination of interventions such as 30–45° head elevation, adherence to hand hygiene, aseptic suctioning, and proper ventilator management yields more optimal results. Therefore, oral hygiene using chlorhexidine should be considered an important component of a comprehensive VAP prevention strategy (Dewi et al., 2023).

Analysis of the total CPIS score showed a significant result with a P value of 0.025 ($p < 0.05$). Before the intervention, seven respondents were categorized as "Suspected VAP" (score >6), but after oral hygiene interventions, this number decreased drastically to only three respondents still suspected of having VAP.

Routine oral hygiene measures in the ICU work through two mechanisms: mechanically destroying the biofilm structure and chemically killing pathogenic microorganisms. The effectiveness of these mechanisms is reinforced by Klompas et al. (2022), who stated that consistent oral hygiene is a critical component of a VAP prevention strategy because it can significantly reduce oropharyngeal bacterial colonization and the risk of aspiration into the lower respiratory tract.

The overall decrease in the CPIS score indicates that this independent nursing intervention is highly effective in breaking the chain of cross-infection and reducing the risk of Ventilator-Associated Pneumonia (VAP). It also demonstrates that maintaining oral hygiene is directly proportional to a decrease in clinical signs of lung infection in ventilator patients.

CONCLUSIONS

The study results showed a significant effect of oral hygiene using chlorhexidine in preventing VAP in

ventilated patients. However, the effectiveness of chlorhexidine cannot be separated from the comprehensive implementation of the ventilator bundle. A combination of interventions such as 30–45° head elevation, adherence to hand hygiene, aseptic suctioning, and proper ventilator management yielded more optimal results.

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