Indonesian Journal of Global Health Research
Volume 7 Number 6, December 2025
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

IMPLEMENTATION OF ORAL HYGIENE WITH PROPOLIS TO PREVENT VENTILATOR-ASSOCIATED PNEUMONIA IN MECHANICALLY VENTILATED ICU PATIENTS

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ABSTRACT
Ventilator-associated pneumonia (VAP) merupakan komplikasi serius yang dapat terjadi pada pasien yang menggunakan ventilator mekanik di unit perawatan intensif (ICU). Oral hygiene is a vital nursing intervention that reduces oropharyngeal colonization and the risk of VAP. Propolis, a natural substance having antibacterial and anti-inflammatory qualities, has been suggested as a substitute for chlorhexidine, which has been linked to side effects. This paper describes the implementation of evidence-based oral hygiene using a propolis solution as part of nursing care for mechanically ventilated patients, with the aim of supporting infection prevention and maintaining clinical stability. Four ICU patients who had been on mechanical ventilation for over 48 hours received oral care using pure propolis diluted in sterile distilled water, administered twice daily for three days. The patients' conditions were monitored through the Beck Oral Assessment Scale (BOAS), the Modified Clinical Pulmonary Infection Score (MCPIS), and the Acute Physiology and Chronic Health Evaluation II (APACHE II). BOAS scores demonstrated improved oral hygiene, while MCPIS values declined, indicating reduced VAP risk. APACHE II assessments suggested stabilization of disease severity. No adverse effects were observed, confirming the safety and feasibility of the intervention in critical care practice. The implementation of oral hygiene with propolis solution, grounded in evidence-based nursing practice, proved to be a safe and practical intervention. Beyond improving oral conditions, it may contribute to VAP prevention and highlights the role of nurses in integrating natural-based, patient-centered strategies into ICU care.

Keywords: evidence-based nursing practice; ICU care; oral hygiene; propolis; ventilator-associated pneumonia

How to cite (in APA style)
Fitria, N. J., Dewi, E., & Nurhayati, F. D. (2025). Implementation of Oral Hygiene with Propolis to Prevent Ventilator-Associated Pneumonia in Mechanically Ventilated ICU Patients. Indonesian Journal of Global Health Research, 7(6), 433–440. https://doi.org/10.37287/ijghr.v7i6.331.

INTRODUCTION

Ventilator-Associated Pneumonia (VAP) is a form of pneumonia that develops after at least 48 hours of mechanical ventilation, whether delivered via an endotracheal tube or a tracheostomy. Some signs of infection in VAP patients include fever, rapid heartbeat, cough, and changes in sputum color (Kemenkes RI, 2017). It is thought that while the endotracheal tube delivers vital oxygen to the patient, it may also act as a route for harmful bacteria originating in the mouth to reach the lungs. Moreover, if the cuff seal on the tube is not perfect in ventilated patients, micro-aspiration of pharyngeal secretions can occur (Zhao et al., 2020).

Maintaining good oral hygiene is essential in lowering the risk of VAP. Patients on mechanical ventilation often develop plaque due to reduced chewing and saliva production, which decreases dental biofilm. However, this plaque can harbor pathogens that may infect the respiratory tract and lead to VAP. Regular oral care and the use of oral antiseptics are effective in controlling bacterial growth, preventing the colonization of bacteria in the upper respiratory tract, and thereby reducing VAP risk (Kusaly et al., 2022). When providing oral hygiene for critically ill patients in ICUs, trained healthcare professionals should thoroughly clear plaque and debris from the oral cavity to prevent contaminated fluids from being aspirated into the respiratory tract. (Zhao et al., 2020).

In many ICUs, Oral care with chlorhexidine is an effective strategy in preventing ventilator-associated pneumonia (VAP) and minimizing bacterial colonization among mechanically ventilated patients (Haq et al., 2023). Although effective, its prolonged use has been linked to side effects, including changes in the oral mucosa, burning mouth syndrome, allergic reactions, and adverse effects from its use as a mouthwash or topical gel. These effects often involve dry mouth (xerostomia), altered taste sensations, particularly salty and bitter tastes, and a discolored or coated tongue (Petrovski et al., 2022). This highlights the need for safer, equally effective alternatives in oral care practices.

Propolis and its derivatives are used in managing various diseases due to their antimicrobial, anti-inflammatory, antioxidant, antibacterial, antifungal, anti-ulcer, anticancer, and immunomodulatory properties. (Pasupuleti et al., 2017). Clinical and in vitro studies have demonstrated its ability to inhibit pathogens such as *Staphylococcus aureus*, *Enterococcus faecalis*, and *Lactobacillus acidophilus*, showing comparable or superior results to chlorhexidine in certain contexts (Nazeri et al., 2019). These findings support propolis as a promising option for ICU patients who are at high risk of VAP occurs in 5% to 67% of critically ill patients, whereas its incidence in Asian countries ranges between 2.5% and 48.1% (Kusaly et al., 2022). This infection results in 1.4 million deaths globally each day. (Rista et al., 2018). VAP in some Indonesian hospitals leads to critical issues in the ICU, including an increase in Length of Stay (LOS) by 10-20 days and Length of Ventilation (LOV) by 10-17.4 days (Kusaly et al., 2022). Given this high burden, integrating evidence-based oral care strategies into nursing protocols is essential. This report describes the implementation of oral hygiene using propolis solution as part of evidence-based nursing practice to support VAP prevention in mechanically ventilated patients.

METHOD

Approach

This report applied an evidence-based nursing practice (EBP) approach. Relevant literature was reviewed through PubMed and ScienceDirect using keywords: *ventilator-associated pneumonia (VAP)*, *oral hygiene*, *propolis*, *mechanical ventilation*, *BOAS*, and *MCPIS*. From 20 identified articles, one study directly addressing nursing care with propolis was selected to guide implementation in the ICU setting (Darbanian et al., 2024).

Patient Characteristics

The implementation was carried out over two weeks in the ICU of a private hospital in Jawa Tengah. Four patients were given the implementation: adults aged 18–75 years, on mechanical ventilation for more than 48 hours, with a Glasgow Coma Scale (GCS) between 6 and 11, and receiving enteral nutrition. Patients had no contraindications for oral hygiene and no known allergies to propolis. Two patients were male and two were female. All were admitted to the ICU for the first time with primary diagnoses related to respiratory or cardiac failure.

Nursing Intervention

Oral hygiene care was performed using a solution of two drops of pure propolis diluted in 15 mL sterile aquadest. Sterile swabs were immersed in the solution and applied to the oral cavity four to six times per session. The procedure was performed twice daily, at 8 AM and 4 PM, for three consecutive days. During each procedure, nurses monitored vital signs, oxygen saturation (SpO_2), and respiratory rate (RR). Patients were positioned with the head of the bed raised to 30° to reduce the risk of aspiration. Suctioning was performed when secretions accumulated (see figure 1).

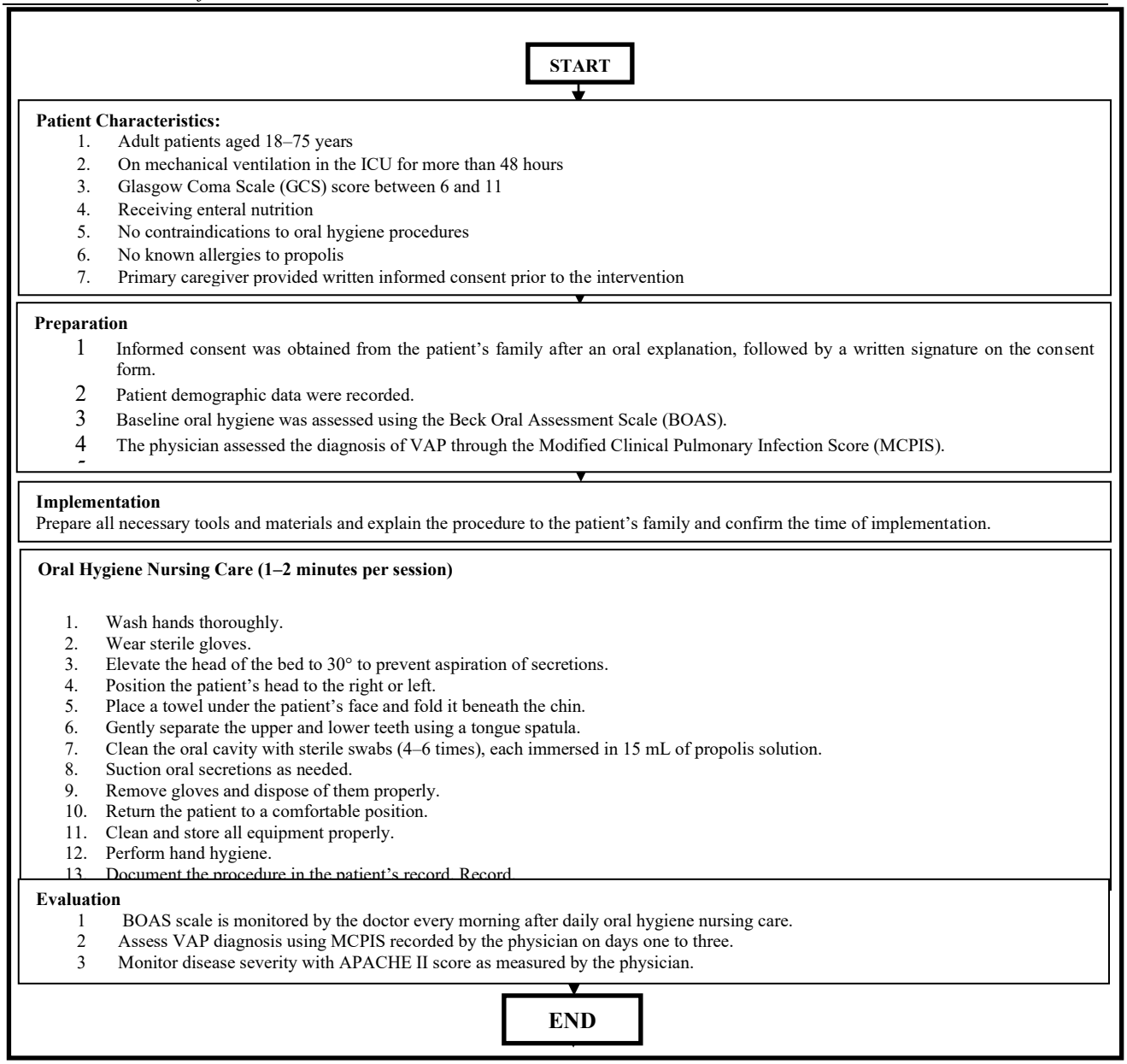

Figure 1. Implementation Flow Chart

Monitoring and Assessment

Patient conditions were evaluated using three instruments. Oral hygiene was assessed with the Beck Oral Assessment Scale (BOAS), which evaluates lips, gingiva, mucosa, tongue, teeth, and saliva, with scores ranging from 5 (good) to 20 (poor) (Pradana et al., 2024). VAP was identified using the Modified Clinical Pulmonary Infection Score (MCPIS). A score of 6 or higher indicates the presence of VAP. Based on the patient's condition, the MCPIS assigns a score from 0 to 2 for each of the five factors: body temperature, white blood cell count, sputum, PaO2/FiO2 ratio, and chest X-ray. (Darbanian et al., 2024). The Acute Physiology and Chronic Health Evaluation II (APACHE II) was applied to assess disease severity, incorporating age and health condition along with 12 physiological parameters. These variables include body temperature, mean arterial pressure, heart rate, respiratory rate, arterial pH, arterial HCO_3, serum sodium, serum potassium, hematocrit, creatinine, leukocyte count, and the PaO_2/FiO_2 ratio. A score below 16 indicates low severity, 16–25 indicates moderate severity, 26–30 indicates severe, and scores above 30 reflect very severe disease. (Darbanian et al., 2024). All assessments were performed by the attending physician before and after nursing care each day. Informed consent was obtained from the patients' families prior to

implementation. Nursing care was delivered in accordance with ICU protocols and ethical nursing standards.

RESULT

Oral Hygiene Condition (BOAS)

Changes in oral hygiene status were evaluated using the Beck Oral Assessment Scale (BOAS) (Figure 2). All four patients demonstrated consistent improvement over the three-day treatment period. Patient 1's score decreased from 14 to 9, Patient 2's from 14 to 10, Patient 3's from 13 to 9, and Patient 4's from 15 to 11. The declining trend in BOAS scores indicates a steady enhancement in oral hygiene after applying the propolis solution. The most significant improvements were seen on the third day, when scores were lower than baseline for all patients.

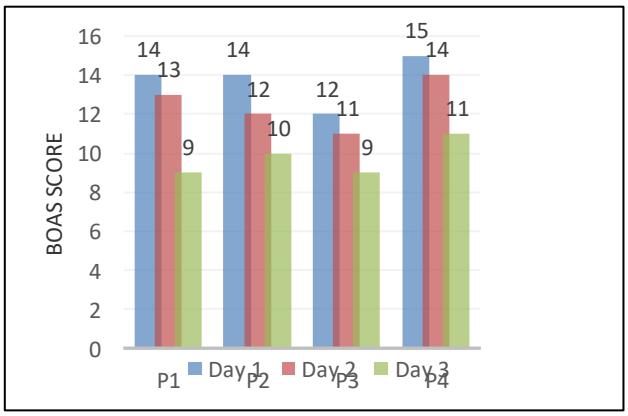

Figure 2. Changes in Beck Oral Assessment Scale (BOAS) scores during oral hygiene care with propolis solution

VAP Evaluation

The assessment of ventilator-associated pneumonia was conducted using the Modified Clinical Pulmonary Infection Score (MCPIS) (Figure 3). From day 1 to day 3, all patients experienced a decrease in MCPIS scores. On day 1, three patients had elevated leukocyte counts, which normalized by day 3. Patient 3 had the highest initial score (6), meeting the diagnostic threshold for VAP; however, this score dropped to 4 by day 3, indicating clinical improvement. Patients 2 and 4 maintained stable PaO_2/FiO_2 ratios without further decline. Overall, the decreasing MCPIS values suggest a reduced risk of VAP following the implementation of oral hygiene with propolis.

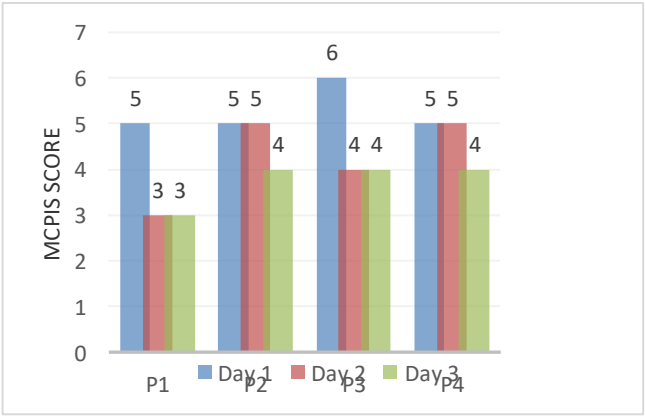

Figure 3. Trends in Modified Clinical Pulmonary Infection Score (MCPIS) during oral hygiene care with propolis solution

Disease Severity

Disease severity was tracked using the Acute Physiology and Chronic Health Evaluation II (APACHE II) score (Figure 4). At baseline, all patients had high scores (26–30), indicating severe illness and a high risk of death. Over three days, scores remained mostly stable, with slight improvement in patient 4 and minor worsening in patient 2. Although oral hygiene with propolis did not directly change disease severity, the intervention helped maintain clinical stability and might aid in preventing further complications.

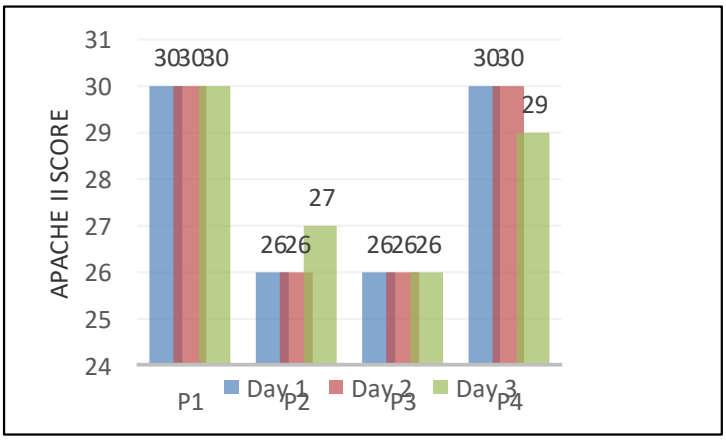

Figure 4. Changes in Acute Physiology and Chronic Health Evaluation II (APACHE II) scores during oral hygiene care with propolis solution

DISCUSSION

According to Metwalley et al. (2023), mechanical ventilation (MV) is recommended for respiratory failure, whether it be hypoxic (type 1), hypercapnic (type 2), or both; loss of upper airway protective reflexes; apnea; and situations requiring high dosages of anticonvulsants and anxiolytics that may affect ventilation and oxygenation, such as when treating status epilepticus. However, the risk of ventilator-associated pneumonia (VAP) rises with extended mechanical breathing. After 48 hours of artificial breathing using a tracheostomy or endotracheal tube, a form of pneumonia known as ventilator-associated pneumonia (VAP) develops. Patients with VAP may exhibit fever, fast heartbeat, coughing, and color changes in their sputum as indicators of infection. These issues raise morbidity and mortality considerably and lengthen ICU stays (Kemenkes RI, 2017).

Oral hygiene care involves maintaining the health of the mouth's tissues and structures. The main aim of oral hygiene is to lower the bacterial colonization of the oropharynx and dental plaque, as well as to reduce the aspiration of colonized saliva that often occurs due to poor oral care in critically ill patients, especially in Intensive Care Units (ICUs). (Alzahraa et al., 2020). Providing oral care with chlorhexidine is an effective method for preventing ventilator-associated pneumonia (VAP) and reducing bacterial colonization in patients on mechanical ventilation. (Haq et al., 2023). Although effective, chlorhexidine is associated with side effects that include changes in the oral mucosa, burning mouth syndrome, allergic reactions, and adverse effects related to its use as a mouthwash or topical gel. These effects often include dry mouth (xerostomia), altered taste sensations particularly salt and bitter tastes and a discolored or coated tongue (Petrovski et al., 2022). These issues motivate the search for safer alternatives.

The present implementation demonstrated that patients who received oral hygiene with propolis solution experienced improvement in oral hygiene (BOAS), reduction in VAP risk (MCPIS), and stabilization of clinical severity (APACHE II). These findings align with Darbanian (2024), who reported lower VAP incidence among patients receiving propolis-based oral care compared to standard care. This consistency across practice and published evidence strengthens the argument

that propolis can serve as a practical and safe adjunct to conventional oral hygiene strategies in ICUs.

The characteristics of propolis provide biological credence to these findings. Bees create propolis, a natural resin, from plant resins, wax, and saliva. Among the several substances found in its extract are phenolic acids and flavonoids. In 2022, Alemrajabi et al. Because of its antibacterial qualities, propolis may prevent the development of bacterial plaque and the infections that cause periodontitis. Propolis mouthwash is used because it can lessen the toxic microflora and bacterial plaque that cause periodontitis and gingivitis. Consequently, propolis has medicinal properties as well. In 2017, Pasupuleti et al. Propolis lowers the risk of bacterial aspiration and consequent lung infection in patients on mechanical ventilation by inhibiting microbial development in the oral cavity. In contrast to antibiotic or chlorhexidine regimens, propolis successfully lowers the incidence of VAP. For ICU patients on MV, propolis mouthwash may be a viable substitute for chlorhexidine.(Darbanian et al., 2024). These outcomes highlight the clinical relevance of integrating evidence-based, natural-derived products into nursing care protocols. While this report does not aim to replace conventional treatments, it illustrates that oral hygiene with propolis can complement existing preventive strategies for VAP. For nurses, the practice not only strengthens infection control but also emphasizes the broader role of nursing interventions in improving patient safety and quality of care in ICUs.

CONCLUSION

The implementation of oral hygiene using propolis solution in mechanically ventilated ICU patients demonstrated consistent clinical benefits. Improvements in oral hygiene status (BOAS), reduction in VAP risk indicators (MCPIS), and stabilization of disease severity (APACHE II) reinforce the value of this intervention in daily nursing practice. Propolis offers a safe and well-tolerated alternative to conventional oral care solutions, addressing both infection prevention and patient comfort. Integrating propolis-based oral hygiene into routine ICU nursing care may therefore represent a practical strategy to enhance patient safety and reduce complications associated with prolonged mechanical ventilation.

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