BNJ BELITUNG NURSING JOURNAL

ORIGINAL RESEARCH

THE EFFECT OF ORAL CARE INTERVENTION ON ORAL HEALTH STATUS OF INTUBATED PATIENTS IN THE INTENSIVE CARE UNIT

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Article Info:
Received: 29 September 2019
Revised: 4 November 2019
Accepted: 14 December 2019

DOI:
https://doi.org/10.33546/bnj.971

Abstract

Background: Oral infections can be a potential source of infection resulting in a variety of systemic diseases, especially in intubated patients in an Intensive Care Unit (ICU). Endotracheal tube (ETT) of the intubated patient's mouth can be an entry point and place of bacteria colonization that causes ventilator-associated pneumonia which is one of the causes of the patient's death in ICU. Nurses as caregivers have an important role in providing oral care intervention to maintain oral health and prevent the infection.

Objective: This study aimed to analyze the effect of oral care intervention on oral health status of intubated patients in the ICU.

Methods: This was a pre-experimental study with one group pre-test post-test design. A consecutive sampling was used to select 18 intubated patients in the ICU of Al Islam hospital in Bandung. Oral health status was evaluated by Beck Oral Assessment Scale (BOAS). Descriptive analysis was used for the univariate analysis and t-test was used for bivariate analysis.

Results: The results showed that oral health scores before and after intervention were 11.94 and 13.28 (p=.004). The BOAS subscales had a significant worsening of the lips, gingiva, oral mucosa and saliva (p<.05), while there was an improvement in teeth subscale after oral care intervention (p<.001).

Conclusion: The results suggested that the oral health status of intubated patients had worsened, despite routinely oral care intervention using chlorhexidine gluconate. Mucosa care may become an essential part of the oral care intervention for intubated patients. Therefore, additional topical agent is needed to maintain the moisture of the mucosal membrane, so that the oral health status of intubated patients will be better.

KEYWORDS
intensive care units; chlorhexidine; pneumonia; ventilator associated; intubation; oral health

ISSN: 2477-4073

INTRODUCTION

Oral health is an integral part of human's health body. Arigbede et al. (2012) stated that chronic infections of the oral cavity can be a potential source of infection resulting in various systemic diseases. Azarpazhooh and Leake (2006) added that the aspiration of pathogenic bacteria in the oral cavity can cause pneumonia, especially in patients in the ICU. This pneumonia is a major cause of patient morbidity and mortality in the ICU (Chastre & Fagon, 2002; Hingston et al., 2010).

Patients in the ICU are critical patients who experience acute failure of one or more vital organs that life-threatening (University of California Davis Health System, 2009). Various tools and monitoring are given to maintain the function of the patient's body, especially the mechanical ventilation through the endotracheal tube after intubated procedure (Morton & Fontaine, 2013; Musliha, 2010). Endotracheal tube (ETT) in a patient's mouth can be an entry point and colonization of bacteria that have the potential causing infection (Chastre & Fagon, 2002; Webb, 2011). In addition, the use of drugs such as bronchodilators, anti-histamines, anti-hypertension, diuretics, atropine, and beta-blockers have side effects of dryness in the oral mucosa (xerostomia). These conditions can worsen the oral health status of intubated patients in the ICU which will increase the oral infections and Ventilator-associated pneumonia (Dale et al., 2013; Mcneill, 2000).

Cohort studies showed that patients in the ICU have a risk of Ventilator-Associated Pneumonia (VAP) by 3% every day during the first week of ventilator use and 2% in the second week (Luna et al., 2003). Ibrahim et al. (2001) stated that the incidence of VAP was quite high between 10-65% with a mortality rate of 20-70%. Thus, VAP becomes a very important problem to be overcome (Cason et al., 2007; Coppadoro et al., 2012; Perrie & Scribante, 2011).

Nurses as caregivers have full responsibility for the care of critical patients in the ICU (Alspach, 2006; Dochterman & Bulechek, 2004). Most critical patients experience a decrease in awareness and inability to fulfil their basic needs. Therefore, the nurses have an important role in providing oral care intervention to maintain oral health and prevent infection (Morton & Fontaine, 2013). The Centre for Disease Control and Prevention (CDC), the American Association of Critical Care Nurse (AACN) and the Institute for Healthcare Improvement (IHI) also emphasized that the oral care program is one of the strategies in the VAP Bundle to prevent VAP in ICU (Pear et al., 2007). The gold standard of oral care intervention of intubated patients includes assessment with oral health assessment tools and the use of antiseptic chlorhexidine gluconate with tooth brushing techniques. Heo et al. (2008) stated that maintaining oral health plays a very important role in preventing the occurrence of VAP because it is related to the colonization of bacteria in the oral and oropharynx. The purpose of this study was to analyze the effect of oral care intervention on the oral health status of intubated patients in the ICU.

METHODS

Study Design

This research was a pre-experimental study with one group pre-test and post-test design.

Sample

A consecutive sampling was used, which resulted in eighteen respondents to be included in this study. The inclusion criterion was intubated patients aged 18 - 70 years old, while exclusion criteria were patients who needed oral care specifically because of teeth or maxillary trauma, and patients who received a change in mechanical ventilation from ETT to tracheostomy during the study.

Instruments

Collecting data included age, sex, disease severity, the usage of drugs that could cause xerostomia, and assessment of oral health status. The APACHE II score was used to assess the severity of the disease. The APACHE II was developed by Knaus et al. (1985) as a modified version of the APACHE scoring system. It was categorized into low severity (<16), moderate (16-25), severe (26-30), and very severe (> 30).

Assessment of oral health status used a modified Beck Oral Assessment Scale (BOAS) instrument developed by Ames et al. (2011) from the oral health assessment of oncology cases. BOAS as assessment tools for oral health status of intubated patients in the ICU has proven to be valid and reliable. Handa et al. (2014) showed that the interrater reliability of BOAS was .92 with a correlation coefficient of .84 and was validated by experts in dentistry, surgical medical in nursing and critical care nursing. In addition, Indonesian version of BOAS has also been validated for use by Manangkot (2015) with a reliability value of .704. BOAS consists of five subscales assessment, included lips, gingiva and mucous membranes, tongue, teeth, and saliva. The rating of each subscale has a range of scores 1-4. The minimum total score of BOAS is 5, while the highest score is 20. The higher the score indicates the patient's oral health status is getting worse.

Intervention

Oral care was performed using a combination between tooth brushing and swabbing technique with a 20-cc chlorhexidine gluconate. Tooth brushing was done by using a pediatric's toothbrush while swabbing used sterile gauze. Chlorhexidine gluconate .2% has been established as a gold standard solution for oral care patients in the ICU since it has a high broad spectrum of antibacterial, antiviral and antifungal activity (Depaola & Spolarich, 2007; Nicolosi et al., 2014). The direction of the toothbrush started from the upper left of the teeth (gingiva) to the right, then from the lower right teeth to the lower left part of the gingiva. After that, the tooth brushed in the lingual part. Tooth brushing was done for at least 2 minutes. The tongue was also brushed from the back to the front carefully to avoid shifting the ETT. Then, swab on the buccal and ETT tube used sterile gauze with chlorhexidine gluconate. Oral care was done every 12 hours for three days. Grap et al. (2011) emphasized that the implementation of oral care is done every 12 hours because it can reduce the Clinical Pulmonary Infection Score (CPIS) score. Oral care procedures began and end with suction because oral care can stimulate secret. Oral health status was assessed before and after oral care intervention.

Data Collection

The study was conducted in the ICU at Al-Islam Hospital in Bandung for two months, April to May 2018. Data were collected by the authors and primary nurses as research assistants in the study. Before data collection, the authors conducted a common perception with the assistants regarding oral care procedures and the use of research instruments.

Data Analysis

Univariate analysis was used to determine the frequency of respondent characteristics. The normality test using Shapiro-Wilk showed normal distribution (p>.05) and the homogeneity test using the Levene test showed that data was homogenous (p>.05). Therefore, the bivariate analysis used Paired sample t-test.

Ethical Consideration

Before collecting the data, the authors had obtained ethical clearance from Central Hospital in Bandung on April 2, 2018 with approval number LB.04.01 / A05 / 3C / 100 / IV / 2018. The authors have ensured that all respondents have received appropriate informed consent.

RESULTS

Based on respondent characteristic data showed that the majority of respondents were women (61.1%) with the majority age ranged between 61 to 70 years (55.6%) and moderate disease severity (72.7%). Besides, all respondents in this study used drugs causing xerostomia such as anti-hypertension, diuretics, and anti-histamine (100%) **(Table 1)**.

Based on the data in **Table 2**, it showed that there was a significant difference between oral health scores before and after oral care (p = 0.04). The mean before and after oral care showed a value of -1.34. This negative (-) value indicated an increase in oral health score after the intervention, which means that the oral health status worsens because the higher the score, the worse the oral health status.

Table 3 showed that there were significant differences in BOAS scores before and after oral care intervention on the lips (p = .003), gingiva and mucosa (p = .003), and saliva (p = .004) subscales. The mean score before and after the three subscales showed negative results (-), which

means that there was an increase in scores after oral care that showed the existence of worsening oral health status. Teeth subscale obtained $p = .000$ ($p<.05$), which indicated that there were significant differences in the teeth subscale before and after oral care. And the mean score of the teeth subscale was positive (+1), which showed a decrease in score, thus there was an improvement in teeth hygiene after oral care intervention.

Table 1 Characteristics of intubated patients in the Al Islam Hospital ICU in Bandung

Characteristics	*n*=18	
	f	%
Gender		
Male	7	38.9
Female	11	61.1
Age		
18 – 40 years old	5	27.8
41 – 60 years old	3	16.7
61 – 70 years old	10	55.6
Disease severity (APACHE II Score)		
Mild	3	16.7
Moderate	13	72.2
Severe	2	11.1
Extremely severe	0	0
Using drugs that causes xerostomia		
Yes	18	100
No	0	0

Table 2 Oral Health Status of Intubated Patients in the Al Islam Hospital ICU in Bandung

Oral Health Score		Mean	*p*-value
Before Intervention Mean ± SD	After Intervention Mean ± SD		
11.94 ± 2.920	13.28 ± 2.024	-1.34	.004*

*Dependent t-test, the significance value was $\alpha<.05$

Table 3 BOAS subscale of Intubated Patients in the Al Islam Hospital ICU in Bandung

BOAS Subscale	Before Intervention Mean ±SD	After Intervention Mean ±SD	Mean	*p*-value
Lips	2.72± 1.074	3.78± .647	-1.06	.003*
Gingiva and oral mucosa	2.33± 1.029	3.00± .767	-.67	.003*
Tongue	2.33± .767	2.39± .608	-.06	.705
Teeth	2.22± .647	1.22± .428	1	.000*
Saliva	2.33± .767	2.89± .758	-.56	.004*

*Description: Dependent t-test, the significance value was $\alpha<.05$

DISCUSSION

The results showed that there was an increase in oral health scores at the end of the assessment. This indicates that there was a worsening of oral health status in intubated patients despite oral care intervention. It can be happen because of multifactorial causes of oral health problems in intubated patients such as increased potential for dental plaque, decreased salivary flow and protection, risk of xerostomia due to open mouth and side effects of drugs (Abidia, 2007; Berry et al., 2007; Prendergast et al., 2012; Urden et al., 2014). O'keefe-Mccarthy (2006) in Dale et al. (2013) also found that intubated patients experience an imbalance of natural airway defense because of the disruption of mucociliary function and due to mucosal damage during intubation. Moreover, critical patients will experience changes in the composition of the flora in the oropharynx into gram-negative organisms within 48 hours (Rello et al., 2003). The results of this study were in line with Ames et al. (2011) who showed that intubated patients will experience worsening oral health status since the first day of intubation. Prendergast et al. (2012) added that the oral health of patients in the ICU worsened along with the increase in the length of days of ETT installation.

Furthermore, the results of the study showed that from the five BOAS subscales, there was a significant increase in scores on the subscales of the lips, gingiva, mucosa, and saliva. This means that there was deterioration of those BOAS subscales. The results of this study were similar to Prendergast et al. (2012) study which showed that there was a significant increase in scores of intubated patients despite oral care intervention. Unlike the case with the three BOAS subscales, the tongue subscale obtained not significant differences in the assessment before and after oral care, and there was an improvement in the teeth subscale.

These results were different from Prendergast et al. (2012) which showed a worsening in the assessment of tongue and teeth. The deterioration might be influenced by the technique of implementing tooth brushing and the type of antiseptic used. This study used chlorhexidine gluconate 0.2% as an antiseptic, while Prendergast et al. (2012) used fluoride toothpaste. Fluoride toothpaste is a type of toothpaste that is often used in hospitals because it can protect tooth enamel, making it more resistant to damage. However, the presence of sodium lauryl sulfate which is the main ingredient of toothpaste can cause dry oral mucosa and worsen the condition of xerostomia if not rinsed evenly in the oral cavity (Herlofson & Barkvoll, 1996). Therefore, Liao et al. (2015), Lorente et al. (2012), and De Lacerda Vidal et al. (2017) stated that chlorhexidine gluconate is an effective antiseptic in inhibiting broad-spectrum gram-negative growth for patients in ICU. Kumari et al. (2013) added that chlorhexidine gluconate can bind to oral tissues, thereby releasing antiseptic effects slowly over a long time, so that it can protect the oral cavity including the tongue from bacterial colonization. Saleem et al. (2016) mentioned that chlorhexidine gluconate is effective for preventing the formation of plaque on teeth.

Another thing that might affect the teeth and tongue subscales was the implementation of oral care techniques. In this study, the oral care technique used a soft-bristled pediatric's toothbrush combined with sterilized gauze. Therefore, the brushing, suctioning and swabbing processes might be carried out optimally. Campbell and Ecklund (2002) asserted that those cleaning processes play an important role in maintaining oral health. Moreover, the implementation of tooth brushing in this study covered all parts of the teeth (gingival and lingual) as well as the tongue. It might cover all parts of the oral cavity. Marino et al. (2016) emphasized that those techniques complement each other in cleaning dental plaque, tongue and all parts of the oral cavity in intubated patients. The use of chlorhexidine gluconate solution, which is a gold standard antiseptic agent, is indeed proven to have high antibacterial, antiviral and antifungal activity with a broad spectrum (Depaola & Spolarich, 2007; Nicolosi et al., 2014). Although the use of chlorhexidine has been proven to be safe, but it has side effects of mucosal irritation and desquamation and causes dry mouth (Azimi et al., 2016; Nicolosi et al., 2014; Potting et al., 2006; Rezaei et al., 2016). This is in line with this study which showed that there was a worsening of the oral mucosa of patients with ETT which was signed by worsening humidity in the lips, gingiva and mucosa subscales.

The limitations of our study were pre-experimental design with a small sample size and the differences of illness severity which might influence the results. Furthermore, the implementation of toothbrush to all parts of the teeth (gingival and lingual) and also the tongue is quite difficult because of the endotracheal tube and patient's response to bite the toothbrush and ETT. Future research is needed a larger sample size with true experimental design and improvement of tooth brushing technique and equipment; therefore, the oral care intervention could be given optimally.

CONCLUSION

Based on the results of this study, it can be concluded that the oral health status of intubated patients in the ICU had worsening of the lips, gingiva, oral mucosa, and saliva subscales despite being given routinely oral care using chlorhexidine gluconate. It could be influenced by the multifactorial that causes the worsening of oral health and the side effects of drugs and chlorhexidine gluconate causing xerostomia. It shows that nurses in the critical care setting should evaluate the oral health status of intubated patients routinely using oral assessment tools as a basis of intervention. Moreover, mucosal care might become an essential part of the oral care intervention for intubated patients.

DECLARATION OF CONFLICT OF INTEREST

We declare that there was no conflict of interest in this research.

FUNDING

Indonesia Endowment Fund for Education, Ministry of Finance Republic of Indonesia.

ACKNOWLEDGMENT

The authors express the deepest gratitude to all respondent who sincerely want to be involved in this research.

AUTHORS CONTRIBUTION

D.T.A., A.T.H., A.N have designed, complied and completed this study together, and the final version of the article was agreed by all authors.

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Cite this article as: Anggraeni, D.T., Hayati, A.T., Nur'aeni, A. (2020). The effect of oral care intervention on oral health status of intubated patients in the intensive care unit. *Belitung Nursing Journal*. *6*(1), 21-26. https://doi.org/10.33546/bnj.971