The Effect of Using an Oral Care Clinical Nursing Practice Guideline on Oral Hygiene Status and Ventilator-Associated Pneumonia in Intubated Patients*

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Abstract

Purpose: To study the effect of using an oral care clinical nursing practice guideline on oral hygiene status and Ventilator-Associated Pneumonia (VAP) in intubated patients.

Design: An experimental study, pretest-posttest control group design

Methods: Twenty four critically ill patients with oral intubation aged 15 years old or over were included. The data was collected by using a demographic questionnaire, an oral assessment form, and a VAP assessment form, and analyzed by using frequency, percentage, means, Mann-Whitney U-test and Chi-square test.

Main findings: After receiving oral care, the participants in experimental group had a significant lower mean score of abnormality of oral hygiene status than those in the control group (p < .05). However, VAP rates in both groups were not significantly different (p > .05).

Conclusion and recommendations: The utilization of this guideline could reduce abnormality of oral hygiene status, but results did not statistically demonstrate a decrease in VAP rates. Further study should increase the sample size and select participants who have been intubated for more than 5 days.

Keywords: clinical nursing practice guideline, oral care, oral hygiene status, ventilator-associated pneumonia, intubated patient
Introduction/Background

Ventilator-Associated Pneumonia (VAP) is the second most common nosocomial infection after urinary tract infections. In Thailand, VAP is identified in intensive care units (ICU) by 36.1%. It increases mortality rate, a patient's length of stay in the ICU and hospitalization, and the overall healthcare cost placed on both the patient's household and hospital. The most significant risk factor of VAP rate is endotracheal intubation. Endotracheal intubation injures tissues in the oral cavity and pharynx leading to an increase in adhesion and colonization of bacteria in the oral cavity. It can also decrease salivary flow that prevents the development of dental plaque. Dental plaque accumulation leads to an abnormality in oral hygiene status and can give rise to conditions such as gingivitis or ulceration, resulting in the overgrowth of pathogenic bacteria. These bacteria in the oral cavity can be aspirated into the lungs, and eventually cause VAP.

Some studies support the belief that oral care interventions can prevent the accumulation of dental plaque and stimulate local oral immunity during the early period of hospitalization, and that this may reduce bacterial colonization causing development of VAP.

In the study by Mori and others regarding the impact of oral care on VAP incidence with 1,662 mechanically ventilated patients in the ICU, VAP rate in the oral care group was 3.9 times per 1,000 ventilator days. This rate was significantly lower than that in the non-oral care group, that was 10.4 times per 1,000 ventilator days (P > .001). This study was in accordance with the literature review by Munro and Grap regarding oral health and care in intensive care unit.

However, no direct studies related to the effect of an oral care clinical nursing practice guideline used with intubated patients on oral hygiene status and VAP have taken place in Thailand. As a result, the researcher was interested in developing oral care interventions to reduce VAP rate in critically ill patients. In this study, the clinical nursing practice guideline for oral care developed by Supattra Nuchakul was applied to assess oral hygiene status and reduce VAP rate in this group of patients. Specifically, this guideline covers the preventive process of the occurrence of VAP.

Research Objectives

1. To compare the oral hygiene status of critically ill adult patients with endotracheal tube receiving oral care based on clinical nursing practice guideline for oral care to that of patients receiving routine oral care.
2. To compare the VAP rate of patients receiving oral care based on the guideline with that of the patients receiving routine oral care.

Research Hypotheses

1. The mean score for abnormality of oral hygiene status in critically ill adult patients with endotracheal tube after receiving oral care based on the guideline will be lower than that of the patients receiving routine oral care.
2. The VAP rate of these patients after receiving oral care based on the guideline will be less than that of the patients receiving routine oral care.

Methodology

This research was an experimental study with a pretest-posttest control group design, aimed at examining the effect of using an oral care clinical nursing practice guideline on oral hygiene status and Ventilator-Associated Pneumonia in intubated patients.

Sample: The sample consisted of 24 critically ill patients with oral endotracheal intubation aged at least 15 years old, admitted into ICUs and general wards of a tertiary hospital in Nakhonnayok. The participants were enrolled using the following criteria.

Inclusion Criteria: (1) No previous diagnosis of pneumonia; (2) intubated for more than 48 hours

Exclusion Criteria: (1) Cannot be placed in semi-fowler position; (2) must not have burns > 20% of total body surface; (3) Be re-intubated; (4) No teeth; (5) ulceration in oral cavity; (6) history of allergy to chlorhexidine mouth wash.
A matched pair technique was applied to control confounding variables of samples. The conditions necessary to constitute a matched pair were as follows: (1) Duration of intubation before the experiment (< 7 VS ≥ 7 days); (2) Use of antibiotics prior to intubation (Yes or No); (3) same rank of oral hygiene status using the Oral Assessment Form.

Participants were then equally divided by a lottery method (12 in the control group and 12 in the experimental one). The control group received routine oral care, whereas the experimental group received oral care based on the clinical nursing practice guideline.

Procedure: After the approval of Mahidol University Institutional Review Board, the researcher recruited the patients based on the above mentioned criteria and obtained formal consent. General routine care for VAP prevention was implemented to all samples in accordance with infection control standards of the hospital to control other confounding factors. The participants in the experimental group received oral care based on the clinical nursing practice guideline by toothbrushing with 0.12% chlorhexidine mouthwash for 15 minutes twice a day, while the participants in the control group received routine oral care by using of cotton swabs with 0.004% chloroxylenol for 15 minutes twice a day.

In both groups, common procedure was performed by the researcher as follows: (1) Recorded demographic data of participants; (2) Assessed the oral hygiene status of each participant by using the Oral Assessment Form and taking a photograph of the oral cavity before cleaning it every morning; (3) Performed different oral cares for each group; (4) Re-assessed the oral hygiene status of each participant by using the Oral Assessment Form and taking a photograph of the oral cavity after cleaning it every evening; (5) Followed up the result of VAP development assessed by physicians on a daily basis based on the clinical and microbiological laboratory data.

Instruments:

1. The clinical nursing practice guideline for oral care was applied from the original guideline developed by Supattra Nuchakul. It consists of 4 steps i.e. assessing oral hygiene status, informing the patient, cleaning the oral cavity, and evaluating outcomes.

2. The demographic questionnaire contained information on gender, age, type of unit, clinical diagnosis, underlying illnesses or surgeries, rank of oral hygiene status, history of smoking or alcohol consumption, use of antibiotics prior to intubation, use of certain drugs, and duration of intubation.

3. The oral assessment form was adapted from the clinical nursing practice guideline for oral care developed by Supattra Nuchakul based on the original ones developed by Ross and Crumpler and Eilers and others. It comprises 5 categories or areas for assessment: lips, mucous membranes/tongue, gums, teeth and saliva. The scores for assessment ranged from 5 to 15 and were classified into 3 ranks with 5 being normal, 6-10 representing mild abnormality and 11-15 representing severe abnormality. Test for inter-rater reliability of this form and the possibility of application was performed by the observation of two nurses on the oral hygiene status of 30 patients, who had similar conditions as the sample, in the same patient and at the same time. The inter-rater reliability of this form was .86.

4. The VAP development assessment form was established by the researcher based on criteria for the diagnosis of VAP, including clinical data and a microbiologic criterion developed by The American Thoracic Society and the Infectious Diseases Society of America.

All instruments were reviewed for content validity and appropriateness of language by 5 experts, including a physician specialized in respiratory care, a dentist, a nursing lecturer specialized in infection control and two nurses specialized in respiratory care of critically ill patients.

Data Analysis: The researcher computed the frequency, percentage, means and standard deviations of the demographic data in both groups. The differences of the demographic data and relevant characteristics between the experimental and control groups were evaluated using the Chi-square test. Means and standard
deviations of the scores of oral hygiene status in both experimental and control groups were also calculated. The Mann-Whitney U-test was then performed in order to observe any significant differences of the mean scores of oral hygiene status before and after care of oral cavity in both experimental and control groups. The VAP rate was finally compared between the experimental and control groups using the Chi-square test.

**Findings**

The findings are shown in relation to the comparison of the demographic data, oral hygiene status, and VAP rate of the control and experimental groups as follows.

1. Demographic data and relevant characteristics classified by participants’ group

<table>
<thead>
<tr>
<th>Demographic data</th>
<th>Experimental group (n = 12)</th>
<th>Control group (n = 12)</th>
<th>P-value (χ²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
</tr>
<tr>
<td>30-44</td>
<td>3</td>
<td>25.0</td>
<td>0</td>
</tr>
<tr>
<td>45-59</td>
<td>6</td>
<td>50.0</td>
<td>3</td>
</tr>
<tr>
<td>≥ 60</td>
<td>3</td>
<td>25.0</td>
<td>9</td>
</tr>
<tr>
<td>Mean= 51.9 SD= 15.1</td>
<td></td>
<td></td>
<td>Mean= 67.0 SD= 11.2</td>
</tr>
<tr>
<td>Type of admission</td>
<td>Medicine</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Surgery</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Rank of oral hygiene status</td>
<td>mild abnormalities</td>
<td>12</td>
<td>100.0</td>
</tr>
<tr>
<td>Use of antibiotics prior to intubation</td>
<td>No</td>
<td>11</td>
<td>91.7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Duration of intubation before the experiment</td>
<td>&lt; 7 days</td>
<td>12</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Mean= 1.7, SD= 0.6</td>
<td></td>
<td>Mean= 1.7, SD= 0.9</td>
</tr>
<tr>
<td>Total duration of intubation</td>
<td>1-4 days</td>
<td>8</td>
<td>66.6</td>
</tr>
<tr>
<td></td>
<td>5-7 days</td>
<td>2</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>&gt; 7 days</td>
<td>2</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>Mean= 4.7, SD= 2.2</td>
<td></td>
<td>Mean= 4.6, SD= 1.8</td>
</tr>
</tbody>
</table>
1.1 Experimental group: There were 12 participants. 50% of them were 45-59 years old. The average age was 51.9 years. 58.3% of them had been admitted in the surgery department. All had mild abnormalities of oral hygiene status. The duration of intubation before the experiment of all participants was less than 7 days. The mean of duration of intubation before the experiment was 1.7 days, whereas 66.6% of them had been intubated for 1-4 days. The mean of total duration of intubation was 4.7 days (Table 1).

1.2 Control group: There were 12 participants. 75% of them were 60 years and above. The average age was 67 years. 66.7% of them had been admitted in the surgery department. All had mild abnormalities of oral hygiene status. The duration of intubation before the experiment of all participants was less than 7 days. The mean of duration of intubation before the experiment was 1.7 days, whereas 58.4% of them had been intubated for 1-4 days. The mean of total duration of intubation was 4.6 days (Table 1).

The Chi-square test indicated that there was no statistically significant difference in most characteristics of the participants between the experimental group and control group (p > .05), except age (p < .05) (Table 1).

2. In relation to the oral hygiene status of the participants before and after care of oral cavity, the findings demonstrated that the mean scores of abnormalities of oral hygiene status in the experimental group were 8.29 and 6.99, while those in the control group were 8.70 and 8.60 (Table 2).

3. In terms of the differences of mean scores of oral hygiene status before and after care of oral cavity in experimental and control groups, the results showed that the mean scores of abnormalities of oral hygiene status before care of oral cavity in the experimental group and the control group were not significantly different (p > .05) (Table 3). However, the mean scores of abnormalities of oral hygiene status after care of oral cavity in the experimental group were significantly lower than those in the control group (p < .05) (Table 3).

4. In terms of the differences of the VAP rate between experimental and control groups, the results showed that the VAP rate in the experimental group was less than that in the control group, however the VAP rates in both groups were not statistically significantly different when the Chi-square test was performed (p > .05) (Table 4).
Table 4: Comparison of Ventilator-Associated Pneumonia (VAP) rate between the experimental group and control group using Chi-square test

<table>
<thead>
<tr>
<th>Development of VAP</th>
<th>Experimental group</th>
<th>Control group</th>
<th>$\chi^2$</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No VAP developed</td>
<td>Frequency</td>
<td>Expected value</td>
<td>Frequency</td>
<td>Frequency</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>11.0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>VAP developed</td>
<td>0</td>
<td>1.0</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Discussion

From the findings, the mean scores of abnormalities of oral hygiene status after care of oral cavity in the experimental group were significantly lower than those in the control group ($p < .05$) (Table 3). Therefore, the first hypothesis of this study is supported. It implied that the utilization of the clinical nursing practice guideline for care of oral cavities contributed to the improvement of oral health by reducing abnormalities of oral hygiene status. The possible reasons underlying such a result are that the participants in the experimental group received oral care by toothbrushing with a modified Bass technique, which is an effective technique for removing debris and dental plaque on cervical and sheltered areas for adults. This technique of massaging gingiva could lead to healthier gingiva and lesser gingivitis. It also stimulated salivary flow resulting in reduction of ulceration. Moreover, moisturizing their lips with petroleum jelly prevented cracked and ulcerated lips. These findings were in accordance with the study of Fitch, Munro, Glass and Pellegrini, which found that patients in ICU who had toothbrushing and petroleum jelly applied to their lips had significantly lower scores in inflammation and dental plaque than those who received routine oral care ($p < .05$).

Furthermore, the participants in the experimental group received oral care with 0.12% chlorhexidine gluconate mouth wash. This oral care technique decreases dental plaque effectively because chlorhexidine inhibits secretion of enzymes involving the adherence of bacteria in oral cavity resulting in the reduction of dental plaque accumulation. After dental plaque decreases, gingivitis and gingival bleeding could be reduced consequently. A few studies found that chlorhexidine gluconate was the most effective cleansing agent for reducing dental plaque and gingivitis.

In relation to the VAP rate, the study found that its rate after care of oral cavity in the experimental group was less than that in control group, but the difference was not statistically significant between both groups ($p > .05$) (Table 4). Therefore, the second hypothesis of this study is not supported. There are a few possible reasons underlying such a result. First, the duration of intubation before the experiment and the total duration of intubation of the participants in both groups were rather short. The means of duration of intubation before the experiment in both groups was 1.7 days, while the means of total duration of intubation in the experimental group and control group were 4.6 days and 4.7 days, respectively (Table 1). As revealed in this study, only two cases in this study had developed VAP (Table 4). In accordance with the study of Kostadima and others, VAP was developed in 90% of head injury and stroke patients who were intubated for more than 5 days. The short duration of intubation therefore would possibly affect the occurrence of VAP in the present study.

Furthermore, the sample size of 24 participants might be rather a small number to support this hypothesis. This small number was essentially due to the limited experimental period in the present study, although the appropriate sample size evaluating the VAP rate should statistically be over a thousand subjects. Nevertheless, the overall result of this hypothesis was in accordance with the previous study of Bopp, Darby, Loftin and Broscious which found that after cleaning the oral cavity of 5 intubated patients by toothbrushing with...
0.12% chlorhexidine gluconate mouth wash, the VAP rate of these patients was not significantly different from those receiving oral care by using cotton swabs.

Conclusion

The results of this study supported that the utilization of a clinical nursing practice guideline for oral care could reduce abnormalities of oral hygiene status. However, the study as designed was unable to effect a reduction in VAP. Further research should increase sample size and select more participants who have been intubated for more than 5 days.

References

ผลของการใช้แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากต่อภาวะสุขภาพช่องปากและการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจในผู้ป่วยที่ใส่ท่อช่วยหายใจ*  

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บทคัดย่อ
วัตถุประสงค์: เพื่อศึกษาผลของการใช้แนวปฏิบัติการพยาบาลในการดูแลความสะอาดช่องปากต่อภาวะสุขภาพช่องปากและการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ

รูปแบบการวิจัย: การวิจัยแบบทดลองประเภทวัดก่อนและหลังการทดลอง

วิธีดำเนินการวิจัย: ศึกษาผู้ป่วยวัสดุที่ใส่ท่อช่วยหายใจทางปากที่มีอายุอย่างต่ำ 15 ปี จำนวน 24 ราย เก็บรวบรวมข้อมูลโดยใช้แบบสอบถามช่องปาก ส่วนบุคคล แบบประเมินภาวะสุขภาพช่องปาก และแบบบันทึกอัตราการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ วิเคราะห์ข้อมูลด้วยสถิติ วิเคราะห์ข้อมูลโดยใช้สถิติทดสอบการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ โดยใช้สถิติMANOVA และใดสเคตร

ผลการวิจัย: ผลการวิจัยได้แสดงให้เห็นถึงความมีผลต่อการดูแลความสะอาดช่องปาก การเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ

สรุปและข้อเสนอแนะ: การใช้แนวปฏิบัตินี้สามารถลดความผิดปกติของภาวะสุขภาพช่องปากและการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ แต่ไม่สามารถลดการเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ เนื่องจากข้อจำกัดของการมีกลุ่มตัวอย่าง ซึ่งมีผู้ป่วยในกลุ่มตัวอย่างกว่า 5 ราย

คำสำคัญ: แนวปฏิบัติการพยาบาล การดูแลความสะอาดช่องปาก การเกิดปอดอักเสบจากการใช้เครื่องช่วยหายใจ ผู้ป่วยที่ใส่ท่อช่วยหายใจ

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