Original Article

The effects of an oral care practice on incidence of pneumonia among ventilator patients in ICUs of selected hospitals in Isfahan, 2010

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Abstract

Background: Oral care plays an inevitable role in health and well-being of patients in intensive care units (ICUs). Poor oral care causes colonization of respiratory pathogens and secondary respiratory infections. Ventilator-associated pneumonia occurs in patients on mechanical ventilation for more than 48 hours. It results in prolonged duration of mechanical ventilation, mortality and health expenses. The present study aimed to review the effects of an oral care practice on the incidence of ventilator-associated pneumonia in patients on mechanical ventilation admitted in ICUs.

Materials and Methods: This was a clinical trial study conducted in the ICUs of selected hospitals in Isfahan during 2010. We randomly divided 54 patients into the intervention and control groups. Intubation was performed during the 48 hours before the study. The intervention group received an oral care practice along with brushing and the control group received routine oral care twice daily. The incidence of ventilator-associated pneumonia was diagnosed through clinical pulmonary infection score (CPIS).

Findings: The two groups were compared in terms of underlying criteria (APACHE-II). The incidence of ventilator-associated pneumonia did not statistically differ between the intervention and control groups (37% vs. 48.1%; p = 0.41).

Conclusions: The results of the present study showed that brushing and standard oral care practice had no effects on ventilator-associated pneumonia. Therefore, the incidence of such complication might be affected by many different factors.

Key words: Oral hygiene, tooth brushing, ventilator-associated pneumonia, intratracheal intubation

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This article was derived from an MSc thesis in Isfahan University of Medical Sciences, No: 386352.

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Quick Response Code:	Website: www.***
	DOI: ***

Introduction

Pneumonia is the most common infection in intensive care units (ICUs) which constitutes 31% of all nosocomial infections in these units.[1] Ventilator-associated pneumonia (VAP) is a common nosocomial infection among patients admitted in ICUs. It is also one of the main reasons of mortality among respiratory infections.[2] VAP is a respiratory disease that occurs after spending more than 24-48 hours from intratracheal intubation and mechanical ventilation.[3] It is experienced by 9-28% of patients treated under ventilator.[4] Ranjbar quoted from Khoueiniha that pneumonia has been the most common infection in ICUs in one of the hospitals of Tehran, Iran (46%).[5] Previous studies in various countries have assessed the prevalence of VAP in ICUs. A study in Thailand reported the incidence of VAP in ICU to be 36%.[6] Likewise, pneumonia has been reported as the most common infection in ICUs in Pakistan, Lebanon, and India with prevalence of respectively 28%, 47%, and 81%.[7] The incidence of VAP increases mortality to 20-55%. It also lengthens the hospitalization duration for 6 days. In addition, the cost per infection to VAP is estimated as $40,000.[8]

Oral flora of diseased patients is different from healthy people and includes some organisms that rapidly cause pneumonia. Forty-eight hours after admission of a patient into the ICU, patient's oropharyngeal flora would be changed into gram-positive streptococci. His dental pathogens would on the other hand turn into gram-negative organisms which are more infectious and include pathogens causing VAP.[9] In intubated patients who do not receive appropriate oral care, dental plaques and bacteria are replaced on the surface of teeth during 72 hours resulting in an incidence of gingivitis and infection.[10] Endotracheal tube creates a path so that the bacteria can directly penetrate into oropharyngeal area.[11] Bacterial colonization in oropharynx is a risk factor for VAP. Therefore, oral hygiene interventions to prevent plaque accumulation and oral safety irritation can reduce pneumonia.[12] Although it has been proven that oral care reduces pneumonia, the frequency of oral hygiene and care is still unclear.[13] The ICU nurses are perhaps in doubt whether to perform oral care for intubated patients since the tracheal tube limits the oral space. They might also feel the fear of endotracheal tube displacement or removal.[14] Cotton swab, which is commonly used for oral care, is effective for stimulating the secretion of saliva but is not effective for removing dental plaque.[15] Although brushing is superior to swabbing, studies have shown swab to be a preferable method in oral care of patients with endotracheal tube.[16]

The studies related to the effects of tooth brushing on the incidence of pneumonia revealed contradictory results.[1,17] While the application of oral care guidelines can significantly improve the oral hygiene status of patients, it does not reduce the VAP.[18] Meanwhile other recent routinely used solutions such as chlorhexidine have not led to certain results.[10] However, no comprehensive study has ever been implemented to prove an oral care protocol in diseased patients. Moreover, none of the conducted studies have determined a clear guide for nursing cares in this regard.[19] Given the aforesaid materials, the present clinical trial aimed to review the effects of an oral care practice on VAP in patients admitted in ICUs.

Materials And Methods

This clinical trial study evaluated patients admitted in the ICUs of Kashani and Alzahra Hospitals, Isfahan, Iran since June 2010 to March 2011. Using convenience sampling method, 54 patients aged 15-65 years, without pneumonia or immunosuppressive diseases and drugs were selected. All participants had been undergoing intubation and mechanical ventilation for 24-48 hours.

The international scale of acute physiology and chronic health evaluation II (APACHE II) was used to evaluate disease severity among patients. APACHE II consists of three parts including age (1 score is added per 10 years for patients over 44 years old), acute physiological status (combination of physiological factors such as vital signs, blood cell count, sodium, potassium, creatinine and arterial blood gas) and also chronic health problems such as liver cirrhosis, angina class IV, chronic obstructive pulmonary disease (COPD), renal failure and immune failure (for each of which 1 score is added). APACHE II scores can range between 0 and 71 with higher scores associated with weaker performance of patient.[20]

Clinical pulmonary infection scale (CPIS) was also used to diagnose pneumonia a week after the intervention. In this repeatedly approved scale, body temperature, the secretions' level and color rather than normal status, changes in white blood cell count (WBC), chest X-ray, hypoxemia, tracheal secretions, culture and gram staining are used to diagnose pneumonia.[21] The scores range from zero to 12 and scores 6 or higher indicate pneumonia. The abovementioned items were measured by the researcher and confirmed by a specialist physician. Moreover, the translated versions of the scales were confirmed by 15 experts.

After obtaining the written consents from the relatives of eligible individuals, the patients were entered into the study. By flipping a coin, subjects were randomly divided into two groups of control or intervention. The sample size was calculated as 27 people per group. After patients entered into study, at the first day, CPIS and disease severity scores were calculated. Suctioning of oral secretions plus tooth and tongue brushing for 3 minutes were performed at 8 A.M. and P.M. for intervention group using a 15 mL chlorhexidine mouthwash 0.12%. The control group also received chlorhexidine mouthwash 0.2% and cotton swab twice a day for a week. After the seventh day, the CPIS scores were reassessed.

Chi-square, Fisher's exact, and paired-t tests were used for statistical analyses in SPSS15.

Findings

The results showed that APACHE II scores had no significant differences in the intervention and control groups (Table 1).

Among the 45 patients who were examined in both groups, 23 patients (42.5%) had pneumonia (intervention = 10 patients (37%); control = 13 patients (48.1%)). There were no significant differences between the two groups despite the difference in pneumonia frequency ($p = 0.41$; $\chi^2 = 68$).

Table 1. Comparing mean acute physiology and chronic health evaluation II (APACHE II) scores of the control and intervention groups

Group	Intervention	Control	Statistical test	
			p	Independent t
Mean APACHE score	11.81	11.77		
SD	4.38	4.02	0.97	0.03
Minimum	7	7		
Maximum	20	24		

The mean disease severity in patients with or without pneumonia was 12.26 and 11.45, respectively. Independent t-test showed that disease severity (APACHE II score) was not significant in those with pneumonia compared to non-pneumonia patients ($t = 0.486$; $p = 0.7$) (Table 2).

Discussion

The results of the present study showed that compared to chlorhexidine mouthwash with swab, applying an oral care (oral hygiene) practice including brushing plus chlorhexidine mouthwash had no significant effects on reducing the incidence of pneumonia due to ventilator in patients admitted in ICUs. The results of this study on the efficacy of this preventive method was in accordance with a number of previous similar studies,[1,17] while in contrast with some others.[22,23] However, some differences in the study design, study population, number of subjects, and the intervention method have made the results problematic to be compared. In fact, since so many factors are involved in the incidence of pneumonia in Iran, it might be impossible to judge and comment about each of them.

Munro et al. found chlorhexidine without brushing to reduce the early occurrence of VAP while it had no effects on the incidence of late VAP (after 7 days).[17] However, similar to our findings, Pobo et al. suggested the combination of tooth brushing and daily oral care not to be effective on reducing the frequency of pneumonia in patients under a ventilator.[1] Although Rujipong et al. found brushing for 15 minutes and also using chlorhexidine 0.12% to improve oral health, they had no effect on pneumonia.[18]

Unlike Grap et al.,[20] in this study, the average CPIS scores in the two groups had no significant differences before and after the intervention. However, several studies have introduced disease severity as one of the risk factors in the incidence of VAP.[15] Disease severity scores over 15 have been found to increase the risk of anaerobic gram-negative pharyngeal bacilli carrier to 33%.[20] In contrast to the present study, Ranjbar et al. reported the group with pneumonia to have higher disease severity scores than the non-pneumonia group.[5] Although mouthwash practice had no significant effects on reducing the incidence of pneumonia, the numerical differences in mean and the higher frequency of pneumonia in the group that received chlorhexidine with cotton swab indicated the need for further investigating the subject. Although numerous factors seem to be involved in the occurrence of VAP in ICUs, the present study could not review all aspects of nursing care due to time limitation and small sample size.

Conclusion

Compared to using chlorhexidine with swab, applying an oral care practice including dental brushing plus chlorhexidine cannot have a significant impact for reducing VAP in patients admitted in ICUs.

Acknowledgment

Thanks go to all individuals who helped us in this study particularly the professors of School of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran and also the respected staff of ICUs in Kashani and Alzahra Hospitals.

Table 2. Comparing mean scores of clinical pulmonary infection scale in the intervention and control groups before and after the intervention

Group	Intervention		Control		Statistical test	
Stage	Mean	SD	Mean	SD	p	Independent t
Before	1.67	1.18	1.85	1.23	0.574	0.56
After	4.33	3.63	4.74	4.1	0.7	0.39
Difference*	2.67	3.58	2.89	4.3	0.84	0.21

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How to cite this article: Khalifehzadeh A, Parizade A, Hosseini A, Yousefi H. **The effects of an oral care practice on incidence of pneumonia among ventilator patients in ICUs of selected hospitals in Isfahan, 2010**. Iranian Journal of Nursing and Midwifery Research 2012; 17(3): 216-219.

Source of Support: Isfahan University of Medical Sciences, **Conflict of Interest:** None declared.