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Effects of oral care with glutamine in preventing ventilator-associated pneumonia in neurosurgical intensive care unit patients

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ABSTRACT

Purpose: The study was designed as a randomized, controlled, experimental study aiming to determine the effects of oral care with glutamine in preventing ventilator-associated pneumonia in patients admitted to neurosurgical intensive care unit.
Methods: The universe consisted of patients who are admitted to neurosurgical intensive care unit between January 2014 and August 2015, while the sample consisted of 88 patients who fulfilled the inclusion criteria and were randomly selected. The study group received oral care with 5% glutamine, whereas the control group received oral care with 2% chlorhexidine gluconate solution.
Data collecting tools: All date was acquired using Patient Information Form, Acute Physiological and Chronic Health Evaluation scale (APACHE II), Beck Oral Assessment Scale (BOAS), Mucosal Plaque Score (MPS) and Clinical Pulmonary Infection Score (CPIS). One-way ANOVA test was used for comparing parameters with normal distribution between groups along with descriptive statistical methods. Kruskal-Wallis Test was used for comparing parameters without normal distribution between groups.
Results: In the control group, mean BOAS score was 9.33 ± 1.8 mean MPS score was 3.68 ± 0.87 and mean CPIS score was 4.07 ± 1.78. In the study group, mean BOAS score was 10.16 ± 2.78, mean MPS score was 3.93 ± 1.04 and mean CPIS score was 3.78 ± 2.25. There was no statistically significant difference in mean scores at 1st day, 3rd day, 5th day and discharge ($p > 0.05$). However, BOAS, MPS, CPIS and APACHE II scores was significantly lower at discharge than 1st day in both groups.
Conclusion: There was no significant difference in using 5% glutamine or 2% chlorhexidine gluconate solution for oral care for the prevention of ventilator-associated pneumonia. Similar studies with bigger sample size and longer term should be conducted for better results.

1. Introduction

Patients with the most severe clinical presentation and longest duration of hospital stay, who undergo invasive interventions most frequently, receive broad-spectrum antibiotics the most and are at highest risk for hospital-acquired infections are patients admitted to intensive care units (Taşbakan et al., 2006). Ventilator-associated pneumonia (VAP) is one of the most frequent nosocomial infections in intensive care unit patients. Ventilator-associated pneumonia is defined as hospital-acquired pneumonia occurring within 48 h after the initiation of mechanical ventilation with tracheal intubation. Since mechanically ventilated patients cannot be fed orally, their salivary secretions decrease, and self-cleansing of the oral cavity is markedly reduced. As a result, oral cavity hygiene worsens, and the number of bacteria increases excessively, leading to bacterial colonization of the oropharynx. Measures taken on time would prevent nosocomial pneumonia and decrease its mortality and morbidity in neurosurgical intensive care unit patients (Augustyn, 2007; Berry, Davidson, Masters, & Rolls, 2007; Furr, Binkley, McCurren, & Carrico, 2004; Munro & Grap, 2004; Munro, Grap, McKinney, Sessler, & Hummel, 2006;Yoneyama et al., 2002).

2. Literature review

Oropharyngeal flora and microorganisms undergo changes within 48 h of admission to the intensive care unit. Endotracheal tubes most

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likely serve as conduits for colonization because these same microorganisms can be traced to respiratory infections. Subglottal suctioning of secretions lying above the endotracheal cuff has proven effective in reducing rates of VAP (Halm & Armola, 2009). Nearly all intubated patients have potential pathogens in the mouth, and 67% have positive sputum cultures for pathogens (Sole, Poalillo, Byers, & Luday, 2002). Munro et al. (2006) found an increase in dental plaque and oral organisms over time in 66 ICU patients with endotracheal intubation. In addition, higher dental plaque scores were correlated with greater risk of VAP. Therefore, appropriate oral assessment and oral care of intubated patients can prevent VAP.

One of the measures to prevent the development of VAP is applying good oral care. Oral care is one of the most basic steps of nursing care practice that provides relief and comfort of the individual who is in critical condition and cannot achieve this simple activity on his/her own. Oral care is important in preventing VAP in terms of reducing the number of microorganism that can reach and infect lungs. The Centers for Disease Control and Prevention (CDC) recommend comprehensive oral hygiene programs for patients at risk for nosocomial pneumonia (Furr et al., 2004; O'Reilly, 2003; Palloş & Şendir, 2012). In their study designed to determine the effect of oral care on pneumonia, Yoneyama et al. (2002) found that oral care do decrease the risk of pneumonia.

Oral care protocol and the solutions used for patients receiving oral care vary (Grap, Munro, Ashtiani, & Bryant, 2003; Noe, 2009). The frequency and duration of oral care and the tools/solutions used may differ between institutions or even between health care providers in the same institution (Cason, Tyner, Saunders, & Broome, 2007). The study by Binkley, Furr, Carrico, and Mc (2004) also showed that the frequency of oral care and solutions/tools used for it differ between institutions and between nurses. Yet the evidence from randomized controlled studies about the technique and frequency of oral care and solution that can be used in intensive care patients is limited (Ames et al., 2011; Berry et al., 2007; Hsu, Liao, Li & Chiou, 2010; Munro et al 2006). A range of antiseptic solutions have been used including chlorhexidine, povidone iodine and hydrogen peroxide. Chlorhexidine is perhaps one of the most commonly used mouthwash solutions identified in studies and has been used as prophylaxis for both chemotherapy and radiotherapy-induced mucositis. A literature review by Halm and Armola (2009) stated that tooth brushing reduces dental plaque formation and oral care using chlorhexidine solutions decreases oropharyngeal bacteria colonization and the risk of VAP. In recent studies, glutamine was reported to be an essential amino acid in critically ill patients. Glutamine is an essential amino acid that is critical for the regulation of protein synthesis, respiratory fueling, and nitrogen shuttling (Erdem et al., 2002; Sarumathy, Ismail, & Palanisamy, 2012). When glutamine is administered topically to patients receiving stomatoxic chemotherapy, moderate and severe oral mucositis was decreased by 20% and the incidence of grade 0 mucositis increased by 10% (Peterson & Petit, 2003).

The number of studies about oral care in the literature has been increasing. Different products and protocols in oral care has been the subject for research. However, the number of studies about glutamine is limited. Therefore, we designed our study to assess the effects of glutamine-used oral care in preventing ventilator-associated pneumonia.

3. Method

3.1. Study design

The study was designed as a randomized, controlled, experimental study aiming to determine the effects of oral care with glutamine in preventing ventilator-associated pneumonia in patients admitted to neurosurgical intensive care unit.

Hypotheses of the study:

H1. Development of ventilator-associated pneumonia is lower in patients receiving oral care with glutamine than with chlorhexidine.

H2. Development of ventilator-associated pneumonia is higher in patients receiving oral care with glutamine than with chlorhexidine.

H0. Development of ventilator-associated pneumonia is not different in patients receiving oral care with glutamine than with chlorhexidine.

3.2. Sample

The universe consisted of patients who are admitted to neurosurgical intensive care unit between January 2014 and August 2015, while the sample consisted of 88 patients, 44 subjects and 44 controls, who fulfilled the inclusion criteria. The group of each patient was decided by drawing lots.

The inclusion criteria were as follows:

- Patient age between 18 and 70
- Patients connected to mechanical ventilation and expected to be connected for at least five days.

The exclusion criteria were as follows:

- Diagnosis of pneumonia at the time of admission,
- Patients receiving chemotherapy and patients with immunodeficiency.

Sample size calculation: We calculated the sample size of our research based on the study cited as "The effects of different oral care protocols on mucosal change in orally intubated patients from an intensive care unit "Hsu SP, Liao CS, Li CY & Chiou AF. Journal of Clinical Nursing, 2010, 20, 1044–1053 doi: 10.1111/j.1365-2702.2010.03515.x". Calculation was performed with 90% GA and 80% power according to "APACHE" mean scores, and sample size of both groups were predicted to be 44 patients each. Win-Epi 2.0 software was used for the sample size calculation.

3.3. Data collecting tools

All date was acquired using Patient Information Form, Acute Physiological and Chronic Health Evaluation scale (APACHE II), Beck Oral

Table 1
Comparison of demographic and disease characteristics of the study and control groups.

	Control group (chlorhexidine)	Study group (glutamine)	p
	Mean ± SD (median)	Mean ± SD (median)	
Age (years)	48,57 ± 17,36	50,93 ± 15,18	0,752[a]
Duration of stay	12,07 ± 8,86 (7)	10,82 ± 6,81 (9)	0,882[b]
1st day APACHE score	21,23 ± 5,47	20,07 ± 6,39	0,684[a]
Sex, n(%)			
Female	26 (59,1%)	27 (61,4%)	0,130[c]
Male	18 (40,9%)	17 (38,6%)	
Diagnosis, n(%)			
Hematoma, SAH, AVM	23 (52,3%)	20 (45,5%)	0,452[c]
Brain tumor	15 (34,1%)	17 (38,6%)	
Hydrocephalus	3 (6,8%)	4 (9,1%)	
MVA, NMVA	3 (6,8%)	3 (6,8%)	
Steroid use, n(%)	22 (50%)	16 (36,4%)	0,387[c]

*$p < 0.05$.
SAH: subarachnoid hemorrhage; AVM: arteriovenous malformation; MVA: motor vehicle accident; NMVA: non-motor-vehicle accident.
[a] One Way ANOVA.
[b] Kruskal-Wallis Test.
[c] Ki-Kare Test.