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Original Article

Comparison of Oral Hygiene Using Chlorhexidine Solution and Hexadol Solution Towards Prevention of Ventilator Associated Pneumonia in Patients with Mechanical Ventilators

Indriana Natalia^{1*} | Achmad Fauzi²

¹Department of RSUD Kota Bekasi, Bekasi, Jawa barat – Indonesia

²Department of STIKes Abdi Nusantara, Jakarta - Indonesia

***contact**

indriananatali81@gmail.com

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Abstract

Aims: This study aimed to determine the effect oral hygiene using chlorhexidine solution and hexanol solution towards prevention of ventilator associated pneumonia in patients with mechanical ventilators.

Design: This type of research is a quasi-experimental study with a Control Group Pretest-Posttest research design

Methods: The data used in this study are primary data with data collection techniques using the observation sheet. Test the hypothesis using the Independent T-Test method

Results: The results showed that there was no significant difference between oral hygiene using Chlorhexidine and Hexadol in the prevention of VAP in Bekasi District Hospital with p value = 0.933 (p value > alpha 0.05).

Conclusions : It can be concluded that there is no difference in oral hygiene using chlorhexidine and hexadol on the prevention of VAP. Future study should conducted similar study using more rigors methods and large sample.

Keywords

Chlorhexidine, Hexadol, Oral Hygiene, Mechanical ventilation

INTRODUCTION

Ventilator Associated Pneumonia (VAP) is one of the incidences of Health-care Associated infections (HAIs) and this nosocomial infection occurs in the intensive care ward. Ventilator Associated Pneumonia (VAP) is defined as pneumonia that occurs 48-72 hours after endotracheal intubation and is characterized by a progressive or recent infiltrate, systemic infection (fever, changes in leukocyte count), sputum changes, and a cause. The incidence of VAP prolongs the length of stay of patients in the ICU with mortality rates reaching 40-50% of total patients (1). VAP is very influential on the continuity of patient care in the ICU. with the occurrence of complications, morbidity and mortality rates are higher, as well as an increase in the cost of care, especially in critically ill patients who are on a ventilator (2,3). In America, VAP is the second cause of HAI and 25% of the incidence of infection in the ICU (4). Meanwhile, in Europe, VAP is the second most common nosocomial infection after urinary tract infection. The crude



mortality rate from pneumonia in Asia reaches 30-70% and specifically pneumonia caused by the use of mechanical ventilation ranges from 33-50% of the pneumonia data in the ICU. The incidence of VAP in critically ill patients ranges from 5% to 67% (5), while the incidence of VAP in Asian countries ranges from 2.5%-48.1% (6). cause various problems for critical patients in the Intensive Care Unit (ICU), namely the extension of the Length of Stay (LOS) for 10-20 and the extension of the Length of Ventilation (LOV) by 10-17.4 days. Meanwhile, mortality data obtained from Singapore was significantly higher, namely 73% of pneumonia as a whole (1).

Although there has been no research on the number of VAP events in Indonesia, based on foreign literature, data shows that the incidence of VAP is quite high, varying between 9-28% in mechanically ventilated patients and the mortality rate due to VAP is as much as 24-50%. The mortality rate can increase to 76% in infections caused by pseudomonas or accinobacter (1).

In a 2014 study conducted by Ni Luh Nyoman Adi Parwati, the incidence of VAP was quite high, between 10-25% and the mortality rate ranged from 10-40%, and could reach 76 % in patients using mechanical ventilation caused by pathogens and accumulation of secretions in the trachea. Rumende (7) reported the incidence of VAP at Dr Cipto Mangunkusumo Hospital (RSCM) of 36% with a mortality rate of 51.4%, meanwhile the incidence of VAP in July – December 2016 at RSCM was 1.2‰ and increased in January – June 2017 reaching 5.3‰, although the increase is still below the target incidence (5.8‰).

VAP occurs due to poor oral hygiene and Endo Tracheal (ET) and the length of ET insertion. Oral hygiene and ET to inhibit the growth of *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Enterobacteriaceae* bacteria in the lungs and bacterial proliferation are also influenced by patient population, length of treatment, and administration of antibiotics. The risk factors associated with VAP such as age, gender, trauma, chronic obstructive pulmonary disease (COPD) and length of ventilator use have been extensively studied. The diagnosis of VAP was made based on the presence of fever (> 38 degrees Celsius), leukocytosis (> 10,000 mm³), purulent tracheal secretions and the presence of new infiltrates based on radiological features.

Proper oral care plays an important role in reducing the occurrence of VAP. A study by conducting oral care intervention with baby toothbrush and chlorehexidine solution for 5 consecutive days in the intervention group showed a difference between the control group experiencing VAP of 9 out of 38 people and the intervention group experiencing VAP of only 3 out of 38 people (8). In another study showed that the risk of VAP in the ICU decreased from 24% to 18% after nurses implemented oral care interventions (9).

There are several phenomena regarding the practice of oral care in critically ill patients in the ICU. Miranda (2016) showed that 49.3% of nurses used a special spatula, gauze, and toothbrush, and 28.2% of nurses only brushed their teeth. The frequency of oral care twice a day is 46.5% and never cleaning is 11.3% (10). In another study with 131 nurses in critical care units as many as 80% of nurses carried out oral care at least

once a day, 20.4% of nurses used toothbrushes with 2% Chlorhexidine Solution and 75.8% of nurses used oral swabs with 2% Chlorhexidine. Solution (11).

The high incidence of VAP can be reduced through oral hygiene with antiseptics such as chlorhexidine 0.2%, the use of chlorhexidine 0.2% as an oral rinse twice a day can reduce the incidence of respiratory tract infections by 69% (12). The effectiveness of using chlorhexidine in patients on mechanical ventilation was assessed by the Clinical Pneumonia Infectie Score (CPIS). The assessment was carried out starting from the patient being intubated and using a ventilator for up to 48 hours, after 48 hours the patient was re-measured using CPIS, if a score > 5 was found, the patient had VAP and if the score was 5, the patient did not experience VAP (13). The use of the antimicrobial hexanol gargle (hexetidine) is an alternative approach for oropharynx decontamination. The antibacterial properties of hexetidine have a broad spectrum against the activity of gram-positive bacteria, gram-negative bacteria and fungi such as *Candida albicans*, *Aspergillus niger*, *Bacillus subtilis*, *Escherichia coli*, including types of multiresistant pathogens such as *Staphylococcus aureus*, *Staphylococcus epidermitis* and *Pseudomonas aeruginosa* (14). Research conducted by Aoun (15) found that hexetidine solution was effective in reducing the number of *Candida albicans* colonies in the mouth by 80% after being used as oral hygiene for 8 hours in 4 consecutive days. Previously, research by Aznita (16) also proved that hexetidine solution used for oral hygiene was very useful for reducing bacterial colonies in the mouth.

The effectiveness of oral hygiene, namely hexanol and chlorhexidine, which are commonly used in patients on mechanical ventilation can be assessed by CPIS. From this CPIS description, it is hoped that researchers can assess the lung condition of patients who are attached to mechanical ventilators which will be very meaningful for the management of the patient's condition and as a reference for further medical treatment. the aimed of this study was to compare the effect of oral hygiene using chlorhexidine solution and hexanol solution against the prevention of ventilator associated pneumonia in patients with mechanical ventilators.

METHODS

This type of research is quantitative research and the design used is "Quasi Experimental Pre-Posttest with Control Group" the treatment given is oral hygiene with chlorhexidine solution and hexanol solution using the Independent T-Test analysis test. This study was conducted to compare the effectiveness of oral hygiene using chlorhexidine and hexanol solutions on the prevention of ventilator-associated pneumonia in patients on mechanical ventilators in Bekasi District Hospital. The number of research samples is 34 respondents who are divided into two groups. The research group was divided into 2 groups, namely the control group (patients on a mechanical ventilator) oral hygiene with chlorhexidine and the treatment group (patients on a mechanical ventilator) oral hygiene with hexanol solution.

RESULTS

Table 1.
Frequency Distribution of Respondents Characteristics of Diabetes Mellitus Patients

Characteristics	Frequency	Percentage (%)
Age		
• Early adulthood (26-35 years)	5	14,7
• Late Adults (36-45 years)	10	29,4
• Early Elderly (46-55 years)	7	20,6
• Late Elderly (56-65 years)	8	23,5
• Elderly (>65 years)	4	11,8
Gender		
• Man	19	55,9
• Woman	15	44,1
Types of Comorbidities		
• Post Surgery	22	64,7
• Neurological Disease	12	35,3
Nutritional Status		
• Albumin \leq 2,2 mg/dl	10	29,4
• Albumin \geq 2,2 mg/dl	24	70,6

Based on Table 1, it can be seen that from 34 Based on Table 1, it can be seen that from 34 respondents more respondents were in late adulthood (36-45 years) as many as 10 people (29.4%) used mechanical ventilation in the ICU, the majority of respondents were male, namely 19 people (55.9%), 64.6% of comorbidities in patients with mechanical ventilation in the ICU, namely postoperative patients, most of the respondents, namely 70.6% of patients with mechanical ventilation, had nutritional status with albumin levels 2.2 mg/dl.

Table 2.
Distribution of VAP Event Frequency Based on CPIS Score

VAP Incident	Chlorhexidin		Hexa		Total	
	f	%	f	%	f	%
Diagnosed with VAP	3	8,8	2	5,9	5	14,7
Not Diagnosed with VAP	14	42,2	15	44,1	29	85,3
Total	17	50	17	50	34	100

Note: Patients was diagnosed with VAP was confirmed from medical records

Based on Table 2, it can be seen that from 34 respondents who were divided into two groups who used mechanical ventilators in the ICU, there were 14 patients who had oral hygiene with chlorhexidine and 15 patients who had oral hygiene with hexadol were not diagnosed with VAP.

Table 3.
CPIS Overview Distribution

Variable		Chlor		Hexa		Total	
		f	%	f	%	f	%
Temperature	36,5-38,4	12	35,3	11	32,4	23	67,6
	38,5-38,9	5	14,7	6	17,6	11	32,4
	<36,5/>=39	0	0	0	0	0	0
Leukosit	>4000 and 11000	10	29,4	11	32,4	21	61,8
	<4000 dan >11000	7	20,6	6	17,6	13	38,2
Secreta	none/little	10	29,4	9	26,5	19	55,9
	There is/not purulent	3	8,8	5	14,7	8	23,5
	Purulent	4	11,8	3	8,8	7	20,6
FiO2	<240	10	29,4	9	26,5	19	55,9
	>=240	7	20,6	8	23,5	15	44,1
X-ray	No Infiltrate	15	44,1	15	44,1	30	88,2
	Diffuse Infiltrate	2	5,9	2	5,9	4	11,8
	Localized Infiltrate	0	0	0	0	0	0
CPIS	0	4	11,8	1	2,9	5	14,7
	1	3	8,8	5	14,7	8	23,5
	2	4	11,8	5	14,7	9	26,5
	3	2	5,9	3	8,8	5	14,7
	4-5	1	2,9	1	2,9	2	5,8
	≥6	3	8,8	2	5,9	5	14,7

Based on Table 3, the results of the analysis show that patients who are on a ventilator who have had oral hygiene measures with chlorhexidine or with hexadol experienced a body temperature of 36.5-38.4 which is about 67.6%, with leukocyte levels >4000 and 11000, namely 61, 8%, no secret or little that is 55.9%, FiO2 level <240 that is 55.9% and with chest x-ray results the majority have no infiltrate that is 88.2%, and with an average CPIS score between 0-5 as much as 26 patients (76.4%).

Table 4.

Oral Hygiene	Mean	SD	SE	P Levene Test	P Value	N
Chlorhexidine	2,35	2,234	0,542	0,348	0,933	17
Hexadol	2,41	1,770	0,429			17

Based on table 4, the results of the Independent T Test analysis show that the average total CPIS score in patients who underwent oral hygiene with chlorhexidine was 2.35, while in patients who underwent oral hygiene with hexadol solution the average CPIS score was 2.41, so that it can be said that there was no difference between the control group (oral hygiene with chlorhexidine) and the intervention group (oral hygiene with hexadol).

Based on the results of the analysis shows the value of Sig. Levene's Test for Equality of Variance is $0.348 > 0.05$, it means that the data variance between the control group and the intervention group is homogeneous. The results of the analysis show that the Sig.2 (tailed) value is $0.933 > 0.05$, so it can be said that H_0 is accepted and rejected by people, which means that there is no significant difference between the average total CPIS score of patients who use chlorhexidine hygiene and patients who use hexadol oral hygiene to prevent the occurrence of VAP.

DISCUSSION

The results of the Independent t Test analysis show that the average value of the total CPIS score in patients who underwent oral hygiene with chlorhexidine was 2.35, while in patients who underwent oral hygiene with hexadol solution the average CPIS score was 2.41., so it can be concluded that there is no difference between the control group (oral hygiene with chlorhexidine) and the intervention group (oral hygiene with hexanol). Oral hygiene is one of the nursing interventions for patients who are on mechanical ventilators with the aim of maintaining the client's oral health and preventing infection and the risk of VAP. Oral hygiene nursing intervention with suction in patients who are on a ventilator is an action that is considered quite difficult by some nurses. The main components that must be considered in carrying out oral hygiene, with suction are the technique of performing the action, the time of execution and the type of fluid used. Modifying oral hygiene measures with suction using 0.2% Chlorhexidine and Hexadol solutions is an alternative to reduce oral fluid residue and prevent the risk of VAP in patients with mechanical ventilation.

Chlorhexidine is an antimicrobial belonging to the bisbiguanide group which is generally used in its gluconate form. Chlorhexidine is a broad-spectrum antimicrobial that attacks Gram positive and negative bacteria, yeast bacteria, fungi, protozoa, algae and viruses. Chlorhexidine is an antimicrobial that has bactericidal and bacteriostatic effects against Gram (+) and Gram (-) bacteria. Chlorhexidine is more effective against Gram (+) bacteria than Gram (-) bacteria. Chlorhexidine is very effective in reducing gingivitis, plaque accumulation, and controlling plaque in the treatment of gingivitis (Akca et al., 2016). Chlorhexidine is also not reported to have a hazard for the formation

of carcinogenic substances. Chlorhexidine is very little absorbed by the gastrointestinal tract; therefore, chlorhexidine has low toxicity (17)

The results of research conducted by (18) explained that chlorhexidine was able to significantly reduce the colonization of oropharyngeal microorganisms, both gram-positive and gram-negative, whereas chlorhexidine had more effect on gram-positive microorganisms. So overall it can be concluded that the use of topical oral decontamination with CHX can reduce the incidence of VAP. The use of this type of 0.2% Chlorhexidine liquid, Genuit, Bochicchio, Napolitano, McCarter, Roghman (19) has also conducted research on the effects of using 0.2% Chlorhexidine on the risk of pneumonia. Based on these studies, it was found that chlorhexidine was able to reduce the risk of pneumonia caused by mechanical ventilation.

(19) article also stated that Chlorhexidine functions as an antiseptic in 3 VAP (Ventilator Associated Pneumonia) reservoirs, namely oral, nasal and prevents bacterial dental plaque in patients with severe head injuries who are treated in the ICU. So it can be concluded that there is an effective use of CHX for oral hygiene with suction in patients who are on a ventilator without using CHX in the prevention of VAP, so that the use of CHX as oral hygiene is felt to be more effective than without using CHX. The use of the antimicrobial hexanol gargle (hexetidine) is an alternative approach for oropharynx decontamination. The antibacterial properties of hexetidine have a broad spectrum against the activity of gram-positive bacteria, gram-negative bacteria and fungi such as *Candida albicans*, *Aspergillus niger*, *Bacillus subtilis*, *Escherichia coli*, including types of multiresistant pathogens such as *Staphylococcus aureus*, *Staphylococcus epidermitis* and *Pseudomonas aeruginosa* (20).

Research conducted by Aoun (2015) found that hexetidine solution was effective in reducing the number of *Candida albicans* colonies in the mouth by 80% after being used as oral hygiene for 8 hours once in 4 consecutive days. The advantages of using hexetidine are also obtained from chemical solutions. Hexetidine binds to oral mucosal proteins so that it can be advantageous when used as an antibacterial. Hexetidine can also prolong the antibacterial effect due to the presence of mucosal proteins. The protein binding inhibits the metabolism of microorganisms that are on the surface of the mucosa and plaque. This bond with the mucosa and plaque occurs for 7 hours after rinsing (20).

Ventilator Associated Pneumonia (VAP) before and before oral hygiene using a hexadol gargle with a p value of 0.003 ($p < 0.05$) which can be used for the use of antiseptic hexadol gargle in the implementation of oral hygiene on the incidence of VAP. in the ICU of Tugurejo Hospital. The use of antiseptic hexadol gargle in the implementation of oral hygiene which is proven to have VAP events is also shown by the results of the study that there were 12 respondents whose CPIS scores after oral hygiene were lower than before oral hygiene (21). Research conducted by (21) also showed that 1 respondent had a higher CPIS score than before oral hygiene using a hexadol gargle, and 2 respondents with the same CPIS score before and before oral hygiene using a hexadol gargle. This is in accordance with the opinion of Mandell (22) that there are times when the use of systemic prophylactic antibiotics does not reduce the incidence of VAP and when the agents used are not appropriate, it can develop

antibiotic resistance. In line with research conducted by (15), proving that hexetidine solution is effective in reducing the number of candida albicans colonies in the mouth by 80% after being used as oral hygiene for 8 hours once in 4 consecutive days. The results of this study are also in line with (12) research which proved that the hexetidine solution used for oral hygiene was very useful for reducing bacterial colonies in the mouth. Based on the results of the analysis shows the value of Sig. Levene's Test for Equality of Variance is $0.348 > 0.05$, it means that the data variance between the control group and the intervention group is homogeneous. The results of the analysis show that the Sig.2 (tailed) value is $0.933 > 0.05$, so it can be said that H_0 is accepted and rejected by people, which means that there is no significant difference between the average total CPIS score of patients who use chlorhexidine hygiene and patients who use hexadol oral hygiene to prevent the occurrence of VAP.

CONCLUSION

It was concluded that there was no significant difference in oral hygiene using chlorhexidine and hexanol. It is recommended for further researchers that the results of this study can provide an overview of the comparison of oral hygiene using chlorhexidine and hexanol on the prevention of VAP.

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