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Araştırma/*Research Article*

The Effect of Preoperative Oral Chlorhexidine Rinse on Ventilator Associated Pneumonia and ICU Mortality After Open Heart Surgery

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Preoperatif Oral Klorheksidinin Açık Kalp Cerrahisi Sonrası Ventilatör İlişkili Pnömoni ve YBÜ Mortalitesi Üzerine Etkisi

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ABSTRACT

Objective: *Ventilator-associated pneumonia (VAP) is the most frequent nosocomial infection in the intensive care unit (ICU). VAP develops 10-20% of patients in 48 hours of mechanical ventilation. In this study, it was aimed to determine the effect of preoperative oral chlorhexidine rinse on VAP and mortality in patients undergoing open cardiac surgery.*
Methods: *300 patients who were planned to undergo elective open cardiac surgery were included in this study. Patients were prospectively randomized into two groups by a computer software. Group 1: Patients brushing their teeth and then gargling with 0.12% chlorhexidine before bedtime at the last night before surgery and 15 minutes before going to the operating room. Group 2, It consisted of patients only brushing their teeth.*
Results: *VAP was seen in 3 patients (2.12%) in Group 1 and in 12 (8.10%) patients in Group 2 (p<0.02). Duration of intubation was 15±7.40 hours for Group 1 and 23 32.01 for Group 2. These differences were statistically significant (p <0.01). Although duration of ICU stay and hospital stay in Group 1 are shorter than in Group 2 but it was not statistically significant (p>0.05). There was no difference in mortality (p>0.05).*
Conclusion: *Consequently, chlorhexidine gluconate rinse before elective cardiac surgery reduced the VAP rate and duration of intubation but did not change the mortality rate and the length of ICU and hospital stay. On the other hand we think these results would be change in large multicentric studies.*

Keywords: *chlorhexidine, ventilator associated pneumonia, ICU mortality*

ÖZ

Amaç: *Ventilatörle ilişkili pnömoni (VAP), yoğun bakım ünitesinde (YBÜ) en sık görülen nozokomiyal enfeksiyondur. 48 saatlik mekanik ventilasyonda hastaların %10-20'sinde VAP gelişmektedir. Bu çalışmada, açık kalp cerrahisi geçiren hastalarda preoperatif oral klorheksidin ile ağız çalkalamanın VİP ve mortaliteye etkisinin belirlenmesi amaçlanmıştır.*
Yöntem: *Çalışmaya elektif açık kalp cerrahisi planlanan 300 hasta dahil edildi. Hastalar prospektif olarak bir bilgisayar yazılımı ile rastgele iki gruba ayrıldı. Grup 1: Ameliyattan önceki son gece yatmadan önce dişlerini fırçalayıp ardından %0.12 klorheksidin ile gargara ve ameliyathaneye gitmeden 15 dakika önce gargara yapan hastalar. Grup 2, Sadece dişlerini fırçalayan hastalardan oluşuyordu.*
Bulgular: *Grup 1'de 3 (%2,12), Grup 2'de 12 (%8,10) hastada VİP görüldü (p <0,02). Entübasyon süresi grup 1 için 15±7,40 saat ve grup 2 için 23±32,01 saatti. Bu farklılıklar istatistiksel olarak anlamlıydı (p<0.01). Grup 1'de YBÜ yatış ve hastanede kalış süreleri Grup 2'ye göre daha kısa olmasına rağmen istatistiksel olarak anlamlı değildi (p>0,05). Ölüm oranında fark yoktu (p> 0.05).*
Sonuç: *Sonuç olarak, elektif kalp cerrahisi öncesi klorheksidin glukonat ile ağız çalkalama, VİP oranını ve entübasyon süresini azalttı, ancak mortalite oranını ve YBÜ ve hastanede kalış süresini değiştirmedi. Öte yandan, bu sonuçların daha geniş çok merkezli çalışmalarda değişeceğini düşünüyoruz.*

Anahtar kelimeler: *klorheksidin, ventilatörle ilişkili pnömoni, YBÜ mortalitesi*

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INTRODUCTION

Ventilator-associated pneumonia (VAP) is a cause of high mortality and morbidity in ICU, therefore its prevention is very important [1]. Since patients undergoing cardiovascular surgery carry additional risk factors different from other patients, they constitute high risk group for the development of VAP [2]. Establishing the leading factors for the VAP and taking protection measures against them that reduce the risk factors determine the prognosis and as important as the treatment of VAP.

Microaspiration of microbial oropharyngeal, gastric and tracheal secretions is the most important cause of VAP in the most cases. There are 350 bacterial species in the normal flora of the oral cavity, and the oral cavity is colonized with these different types of bacteria [3].

Theoretically, lowering the oropharyngeal bacteria level prevents dental biofilm formation and bacterial plaque and can also lead to a decrease in the incidence of nosocomial pneumonia [3,4]. 0.12% - 2% chlorhexidine gluconate oral rinse which is used for this purpose is an agent with high affinity for skin and mucous membranes, effective against aerobic and anaerobic bacteria, and its bactericidal and bacteriostatic activity continues for 12 hours. The United States Institute for Health Care Improvement added daily oral care with chlorhexidine gluconate to the ventilator care package in 2010 [5,6]. Although there are many data on regular oral care with antiseptic solutions with chlorhexidine in intubated patients after cardiac surgery reducing the bacterial colonization, studies on the effectiveness of preoperative use are limited [1-3]. In this study, it was aimed to determine the effect of preoperative oral chlorhexidine rinse on VAP development and the relationship between morbidity and mortality in patients undergoing open cardiac surgery.

MATERIAL and METHODS

After the Hospital Education Planning and Coordination Committee approval and obtaining informed consent of the patients, 300 patients who were planned to undergo elective open cardiac surgery between December 2013 and June 2014 were included in this study. Patients were prospectively randomized into two groups by a computer software.

Group 1: Patients brushing their teeth and then gargling with 0.12% chlorhexidine not less than 10 ml for at least 45 second before bedtime at the last night before surgery and 15 minutes before going to the operating room.

Group 2: It consisted of patients only brushing their teeth.

The same anesthesia and surgery protocol were applied to all patients. Demographic data of patients; concomitant diseases such as Hypertension (HT), Diabetes Mellitus (DM), Chronic Obstructive Pulmonary Disease (COPD); European cardiac operative risk assessment system (EuroSCORE), cross-clamp (CC) and cardiopulmonary bypass (CPB) duration, inotropic agents and intra-aortic balloon pump (IABP) requirement, reoperation conditions were recorded.

Patients who had hemodynamic stability, provided sufficient hemostasis and had sufficient gas exchange according to blood gas analysis were separated from the mechanical ventilator. Pneumonia prevention package was applied to all patients with extended intubation. Care was taken to ensure that all patients had endotracheal cuff pressures of 20-30 mmHg and bedheads of 45°. Oral care with chlorhexidine was performed to the patients 3 times in a day who could not be separated from the mechanical ventilator. Endotracheal aspirate (ETA) was sent from patients who were considered to have VAP clinically, and those with a Clinical Pulmonary Infection Score above 6 were accepted as VAP. Intubation period, duration of intensive care unit stay and mortality of all patients were recorded.

RESULTS

In order to evaluate the findings obtained in this study, SPSS 21.0 statistical package program was used. In comparison of the data, the test of the differences between the two groups (Independent Samples “t” test) and the Mann Whitney U test were used for the categorical data. The results were evaluated in the 95% confidence interval and the signifi-

Table 1. Preoperative and peroperative features of the groups.

Features	Group 1 (N:141) Mean±SD	Group 2(N:148) Mean±SD	P value
Age	58,35±11,333	55,07± 11,99	ns
Height (meter)	1,68±7,9	1,69±7,96	ns
Weight (kg)	76,77±9,57	79,87±11,18	ns
Body Mass Index (kg/m^2)	27,18±3,84	27,88±4,09	ns
EUROSCORE	3.42±2.62	2.80±2.68	*0.02
	N(%)	N(%)	
Concomitant diseases (+)			
Hypertension	89 (63,1)	92 (62,2)	
Diabetes Mellitus	52 (36,9)	45 (30,4)	ns
COPD	7 (5)	8 (5,4)	
Hypothyroid	3 (2,1)	4 (2,7)	
Surgical Intervention			
CAB surgery	98	107	
Valvular procedure	27	25	ns
CAB+ Valvular procedure	13	11	
Aneurysm repair	1	3	
Congenital heart surgery	2	2	
Cross Clamp Duration (minute)	69,78±30,79	62,85±24,23	ns
Cardiopulmonary Bypass (minute)	103,46±37,42	95,42±30,41	ns
Reoperation	6 (4,3)	2 (1,4)	ns
Inotropic agent			
Yes	42 (29,8)	40 (27)	ns
No	99 (70,2)	108 (73)	

COPD: Chronic obstructive pulmonary disease CAB: Coronary artery bypass

cance level was p<0.05.

A total of 289 patients were included in this study. Nine patients in Group 1 were excluded from the study because they did not gargle, and 2 patients in Group 2 were excluded because they did not brush their teeth. VAP was seen in 15 patients (15/289, 5.19%).

In Group 1, there were 101 male (71.60%), 40 female (28.40%); Group 2, there were 104 male (70.30%) and 44 female (29.70%) patients. The characteristics of the groups are shown in Table 1. While the groups were similar in terms of demographic data, additional diseases, CPB and CC time, inotropic agents; EuroSCORE values of Group 1 patients were found to be significantly higher than Group 2 (p <0.02). The

Table 2. Types of surgery.

Variables		Group 1 (n=141)		Group 2 (n=148)	
		N	%	N	%
Types of Surgery	CAB surg.	96	68,1	107	72,3
	Redo CAB surg.	2	1,4	0	0
	AVR+MVR+CAB surg.	1	0,7	1	0,7
	MVR surg.	14	9,9	9	6,1
	AVR surg.	3	2,1	8	5,4
	Bentall procedure	4	2,8	3	2,0
	Redo AVR surg.	1	0,7	0	0
	AAA repair + CAB surg.	2	1,4	0	0
	AVR+MVR+TVR surg.	1	0,7	0	0
	Mitral Repair surg.	1	0,7	1	0,7
	MVR+CAB surg.	7	5,0	7	4,7
	ASD repair	1	0,7	1	0,7
	MVR+TVR surg.	1	0,7	3	2,0
	AVR+CAB	2	1,4	2	1,4
	CAB + Mitral Repair	1	0,7	0	0
	ASD repair	1	0,7	1	0,7
	AVR+MVR surg.	1	0,7	0	0
	Redo MVR surg.	1	0,7	1	0,7
	LV Aneurysm Repair	1	0,7	0	0
	AAA repair	0	0	2	1,4
	IHSS repair	0	0	1	0,7
	Bentall procedure +CAB	0	0	1	0,7

CAB: Coronary artery bypass AVR surg.: Aortic Valve Replacement surgery, MVR surg.: Mitral Valve Replacement surgery, TVR surg.: Tricuspid Valve Replacement, AAA repair: Ascending Aortic Aneurysm Repair, ASD repair: Atrial Septal Defect Repair, LV Aneurysm Repair: Left ventricule Aneurysm Repair IHSS repair: Idiopathic Hypertrophic Subaortic Stenosis

groups were similar in terms of the types of surgery performed (Table 2).

VAP was seen in 3 patients (2.12%) in Group 1 and in 12 (8.10%) patients in Group 2 (p<0.02). Intubation time was 15±7.40 hours for Group 1 and 23±32.01 for Group 2. These differences were statistically significant (p <0.01). Although duration of ICU stay (34.06±21.89 hours) and hospital stay (9.58±7.573 days) in Group 1 are shorter than in Group 2 (duration of ICU stay: 39.83±34.44 hours, hospital stay: 11.63±11.82 days), these differences were not statistically significant (p>0.05). In this study, 3 patients (2.1%) in Group 1, 8 patients (5.4%) in Group 2 died, and no difference in mortality rate was detected between the two groups (p>0.05).

DISCUSSION

It has been determined that preoperative 0.12% oral chlorhexidine rinse in patients undergoing cardiac surgery decreases the duration of intubation and the VAP incidence but does not affect ICU stay, hospital stay and mortality. The EuroSCORE levels of the same group were high so this might be the reason of the similarity the length of hospital and ICU stay and mortality.

VAP is a disease seen in patients who are mechanically ventilated in ICU and it's incidence increases with prolonged intubation. It was shown that the risk of developing VAP during the first week of mechanical ventilation increased by 3% per day [7]. Since patients who undergo cardiovascular surgery have additional different risk factors than other patients, they constitute a special subgroup for VAP risk. In these patients, risk factors such as low ejection fraction (EF), long duration of CC and CPB, inotropic support, and use of IABP can increase the duration of intubation [2]. Hortal et al. [8] stated that 2.1% of 986 patients undergoing cardiac surgery developed VAP and the incidence of VAP was 13.9 per 1000 ventilator days and ascending aorta surgery, blood product use, reoperation, peripheral vascular disease and presence of renal disease, ASA> 3, inotropic support, IABP requirement, the length of the operation time and the duration of mechanical ventilation were determined as the risk factors associated with VAP. Therefore, it is imperative that all precautions are taken precisely to prevent the development of infection in these patients. Aspiration of oropharyngeal organisms and prevention of colonization are among the main targets in the prevention of VAP development [9]. Fourrier et al. [10] reported that patients who were followed up in the medical ICU, using 2% chlorhexidine gluconate 3 times a day, had a lower nosocomial infection rate compared to the control group, which reduced the duration of mechanical ventilation, length of ICU stay and mortality.

Due to the medical and mechanical supports applied to patients whose cardiac functions are not good after cardiac surgery, their stay in ICU is prolonged, this leads to the colonization of patients by pathogenic microorganisms, and VAP can be observed in these patients at a higher rate [11]. In our study, advanced age, inotropic agents and IABP use, reoperation, duration of intubation, ICU and hospital stay were found to be longer in patients who developed VAP and these variables were evaluated as risk factors for VAP development. Operation of patients with high preoperative risks is a factor that leads to increased mortality and morbidity in these patients. In our study, although the preoperative EuroSCORE of Group 1 patients using chlorhexidine was higher, the rate of VAP was found to be lower in these patients. Oral decontamination with chlorhexidine has been shown to be effective in preventing VAP in cardiac surgery patients intubated for more than 24 hours [4]. De Riso et al. [12] found that there was a 65% reduction in nosocomial infection rate and 69% reduction in respiratory infection incidence with 0.12% chlorhexidine gluconate rinse in patients undergoing open cardiac surgery. De Riso recommended chlorhexidine gluconate rinse because of its cheapness, easy administration and for the ability in reducing the rate of infection. Similarly, Nicolosi et al [13] stated that 0.12% chlorhexidine gluconate rinse in cardiac surgery reduces the risk of VAP 3 times. In the study of Houston et al. [14] 561 patients who were undergoing cardiac surgery were randomized into two groups as chlorhexidine rinse and phenolic mixture. In their study, it was found that the incidence of VAP was 71% less in patients chlorhexidine gluconate rinse who were followed up for more than 24 hours intubated.

Contrary to the above studies, Jacomo et al. [15] did not observe any difference in terms of intubation time, reintubation need, ICU and hospital stay in their study of pediatric patients who underwent cardiac surgery and they reported that chlorhexidine gluconate rinse does not decrease the VAP incidence. Pineda et al. [16] examined four studies in the meta-analysis and they stated that there was no decrease in VAP incidence in patients who used chlorhexidine as a local antiseptic in the oral cavity. Contrary to these studies, in our study it was observed that oral decontamination with chlorhexidine gluconate reduced the incidence of VAP. Segers and Chan stated that they did not observe a difference in mortality rate between patients using chlorhexidine and the control group in their study. They stated that this was probably due to the fact that since the EuroSCORE of the patients were below 5%, the mortality rate was low [17,18]. In our study, no difference was found between the two groups in terms of mortality rate. However, although EUROSCORE scores have higher in the group of patients using chlorhexidine, the fact that the VAP rate is lower in these patients is significant in terms of showing that chlorhexidine rinse is effective in these patients.

Consequently, chlorhexidine gluconate rinse before elective cardiac surgery reduced the VAP rate and intubation time but did not change the mortality

rate and the length of ICU and hospital stay. However, the facts such as the patients in Group 1 having higher EuroSCORE, not fully ensured homogeneity between groups caused possible no difference in the ICU and hospital stay and mortality variables. Therefore, it is recommended to use chlorhexidine in large and more homogenic series of patients after cardiac surgery.

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