



ORIGINAL ARTICLE

## To compare the frequency of ventilator-associated pneumonia among mechanically ventilated patients with four- hourly chlorhexidine mouthwash vs six-hourly chlorhexidine mouthwash.

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**ABSTRACT... Objective:** To compare the frequency of ventilator-associated pneumonia among mechanically ventilated patients with four hourly chlorhexidine mouthwash vs six hourly chlorhexidine mouthwash. **Study Design:** Randomized Controlled Trial. **Setting:** Surgical Intensive Care Unit of the Department of Anesthesia, Shifa International Hospital, Islamabad, Pakistan. **Period:** January 2020 to June 2020. **Methods:** Eighty patients admitted to ICU and mechanically ventilated for at least 48 hrs were randomly allocated, and 40 patients were treated with chlorhexidine mouthwash four-hourly per day group1, and 40 received chlorhexidine mouthwash six-hourly group2. The primary researcher followed patients for up to 7 days. Lower respiratory tract specimens were obtained on admission, and after 48 hrs of intubation, findings were entered in proforma. **Results:** The average age of the patients in group 1 was  $37.55 \pm 10.16$  years and in group 2 was a  $38.65 \pm 9.25$  year. There were 38(47.5%) male and 42(52.5%) female. The frequency of VAP was not significant between groups (11.25% vs 6.25%,  $p=.23$ ). It was observed that the rate of VAP was not significant between groups in all age stratification. Gender stratification was performed and observed that no difference was found between groups. The frequency of VAP in females in group 1 was 7 (35%) and 4 (18.2%) in group 2, with  $p\text{-value}=0.21$  and  $\text{Chi-square}=1.53$ . The frequency of ventilator-associated pneumonia differed between groups for males in group 1 (35%) and 1 (5.6%) in group 2, with  $p\text{-value}=0.61$  and  $\text{Chi-square}=0.25$ . **Conclusion:** Our study concludes that oral hygiene care incorporating chlorhexidine mouthwash effectively reduces the development of VAP in adults in ICU. We found no difference between the efficacy of four hourly and six-hourly chlorhexidine mouth wash in VAP frequency.

**Key words:** Chlorhexidine Mouthwash, Pneumonia, Ventilator.

### INTRODUCTION

Nosocomial infection is quite common in patients of intensive care units owing to decreased immune function because of blood loss, anesthesia, and tissue damage.<sup>1</sup> The most common cause of mechanical ventilation, hospital stays, and unfavorable outcomes is ventilator-associated pneumonia (VAP).<sup>2</sup> ventilator-associated pneumonia (VAP) occurs in patients who have been on mechanical ventilation and end tracheal intubation for at least 48 hours.<sup>3</sup> Ventilator-associated pneumonia is the leading modality in hospital-acquired infections and affects almost 10 to 30% of patients who are ventilated mechanically.<sup>3</sup> The global prevalence of ventilator-associated pneumonia is 15.6 %. It

has not significantly decreased despite all the preventive measures and the use of ventilator-associated pneumonia care bundles.<sup>4</sup>

VAP can be effectively prevented by decreasing oral microorganisms.<sup>5</sup> Oral hygiene includes suctioning, brushing and, use of mouthwashes.<sup>5</sup> Improving oral hygiene can lead to decreased dental plaque by decreasing the risk of ventilator-associated pneumonia.<sup>6</sup> A variety of antimicrobials have been known for chemical plaque control. One of them is chlorhexidine.<sup>7</sup> The incidence of pneumonia caused by ventilators has been found to be reduced in many trials that tested intraoral disinfection with chlorhexidine.<sup>6</sup> The results supported the recommendation that the critical

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care unit enhance their mouth hygiene practices.<sup>6</sup> As a result, we concluded that the elevated prevalence of ventilator-associated pneumonia was due to insufficient dental hygiene.<sup>6</sup> In one study, the prevalence of pneumonia associated with ventilators was significantly greater in the control group (68.8% vs. 41.1% in the chlorhexidine group) compared to the other group.<sup>6</sup>

The objective of this study was to compare the frequency of ventilator-associated pneumonia among mechanically ventilated patients with four-hourly chlorhexidine mouthwash VS six-hourly chlorhexidine mouthwash.

## METHODS

This randomized controlled trial was carried out in the surgical intensive care unit of the Department of Anesthesia, Shifa International Hospital, Islamabad, Pakistan for a period of Six months from January 2020 to June 2020.

The World Health Organization's sample size calculator yielded a 95% confidence interval, a 5% significance level, and a 90% power level. Anticipated population proportion (P1) = 41.1 %, Anticipated population proportion (P2) = 10%.<sup>6,9</sup> We determined that 40 people would make up each group's sample. Patients with a history of chlorhexidine hypersensitivity, oral mucosal disease, or a suspicion of respiratory tract infection upon admission were excluded from the study. Inclusion criteria included a patient age range of 15–60 years who had been mechanically ventilated for at least 48 hours during their intensive care unit stay.

After the approval from the Hospital Ethical Committee (ref.No.IRB.No. 624-072-2016) and informed written consent of the patient, participants were divided into two groups randomly based on the lottery method. Two groups were given oral care: Group A received four daily swabs of chlorhexidine applied to the oral mucosa, and Group B received six daily swabs. The application of 30ml of 0.2 % chlorhexidine by attending nursing staff for oral care lasted for one minute. Nearly every six hours, deep suctioning was carried out. The main

investigator monitored patients for a maximum of seven days, or until they were either extubated, discharged from the intensive care unit, or died. Lower respiratory tract specimens were obtained on admission and after 48 hours of intubation. The sample was obtained by inserting a sterile suction catheter into the endotracheal tube as part of a mini broncho-alveolar lavage procedure, and the results were recorded in a proforma. Ventilator-associated Pneumonia was diagnosed as patients mechanically ventilated for more than 48 hours, with any two of the following:

1. Purulent tracheal aspirates (clinical criteria) with fever >38 C.
2. Leukocytosis: WBCs count > 11.0 x 10<sup>9</sup> per liter.
3. Positive culture of tracheal aspirates (microbiological criteria) with the organism's growth on the culture plate. This was taken by active suctioning.
4. Appearance of infiltrates on chest x-ray (radiological criteria), which was normal previously.

All of the data was input and analyzed using SPSS. Quantitative variables, like age, had their means and standard deviations determined. Qualitative variables, such as gender and the VAP, were quantified using percentages and frequencies. The frequency of ventilator-associated pneumonia was compared between the two groups using chi-square. A p-value of  $\leq 0.05$  represented statistical significance. Stratification was then used to adjust for effect modifiers such as gender and age. After the stratification process, the chi-square test was applied.

## RESULTS

Most of the patients were above 30 years of age. The average age of the patients in group A was  $37.55 \pm 10.16$  years and in group B was  $38.65 \pm 9.25$  years. There were 38(47.5%) male and 42(52.5%) female.

The frequency of ventilator-associated pneumonia was not statistically significant between the study groups. (Table-I)

Ventilator Associated Pneumonia	Group A	Group B	P-Value
Yes	12(30%)	4(10%)	0.264
No	28(60%)	36(90%)	

Chi-Square= 1.25

**Table-I. Comparison of frequency of ventilator associated pneumonia between groups for below and equal to 30 years of age**

It was also observed that the frequency of ventilator-associated pneumonia was also not significant between groups in all age stratification, as shown in Table-II and III.

Ventilator Associated Pneumonia	Group 1 n=14	Group 2 n=19	P-Value
Yes	1(7.1%)	4(21.1%)	0.271
No	13(92.9%)	15(78.9%)	

Chi-Square= 1.21

**Table-II. Comparison of frequency of ventilator associated pneumonia between groups for 31 to 40 years of age**

Ventilator Associated Pneumonia	Group 1 n=16	Group 2 n=11	P-Value
Yes	5(31.3%)	0(0%)	0.06
No	11(68.8%)	11(100%)	

Fisher Exact test used

**Table-III. Comparison of frequency of ventilator associated pneumonia between groups for >40 year of age**

Gender stratification was performed and observed that no difference was found between groups. The frequency of ventilator-associated pneumonia in females in group A was 7 (35%) and 4 (18.2%) in group B, with p-value=0.21 and Chi-square=1.53. The frequency of ventilator-associated pneumonia differed between groups for males in group A (35%) and B (5.6%) in group 2, with p-value=0.61 and Chi-square=0.25.

## DISCUSSION

Patients in critical care units often require mechanical breathing assistance, such as ventilators, because they may be unconscious or sedated throughout treatment. Patients risk developing ventilator-associated pneumonia (VAP) if they use this equipment for longer than

48 hours. When it comes to nosocomial infections in intensive care units, ventilator-associated pneumonia (VAP) ranks second overall and first for patients on mechanical ventilation.<sup>8</sup>

Increases in healthcare expenditures, morbidity, mortality, and intensive care unit (ICU) stays are all linked to this illness.<sup>9</sup> There has been progress in the identification and treatment of VAP, but the attributed death rate remains between 33 to 50%, making it a significant medical concern.<sup>10</sup> Consequently, measures to avoid it should be taken. Colonization of the typically sterile lower respiratory tract by microbes commonly present in the trachea, oropharynx, stomach, and small or large intestines is associated with the development of VAP. The oropharyngeal tract is the principal site of VAP infections, however the exact mechanism by which these infections spread to the lower respiratory system is still a mystery.<sup>11</sup> In light of this, a great deal of research has looked at the role of topical oral antiseptics in preventing VAP. Numerous randomized controlled clinical trials examining the impact of oral chlorhexidine usage in VAP prophylaxis have demonstrated that chlorhexidine gluconate, among these antiseptics, has garnered substantial attention.<sup>12</sup> This research aimed to assess the incidence of ventilator-associated pneumonia in patients on mechanical ventilation who used chlorhexidine mouthwash four times per hour vs six times per hour. Eighty patients who required mechanical ventilation for a minimum of 48 hours after admission to the critical care unit were included. Two groups were formed from these patients at random. Forty patients in Group A were given chlorhexidine mouthwash every four hours, whereas forty in Group B were given the same medication every six hours.

We found that patients in the surgical intensive care unit (SICU) who regularly used chlorhexidine mouthwash as part of their ventilator management bundle had a lower risk of developing probable ventilator-associated pneumonia (VAP). Our study observed no difference in the prevalence of ventilator-associated pneumonia among mechanically ventilated patients between the two groups when it came to the effectiveness of

chlorhexidine mouthwash, administered either four or six hours apart. The efficacy of chlorhexidine in preventing VAP has been the subject of conflicting findings in previous research. Our results are in line with prior research that found a 69.1% decrease in respiratory tract infections in patients who used chlorhexidine mouthwash after mechanically ventilated heart surgery.<sup>13</sup> Prophylactic chlorhexidine in patients undergoing non-cardiac surgery is one example of an oral care strategy that some studies have found to provide little to no added benefit. On the other hand, some research has shown that it improves clinical results.<sup>14</sup> There was no therapeutic advantage to chlorhexidine prevention based on the formation of VAP through the usage of CPIS, according to a research that included patients from three different intensive care units (medical respiratory, neurosurgical, and surgical trauma) at a university medical institution.<sup>13</sup> According to the study reported by Grap et al.<sup>15</sup>, chlorhexidine did not decrease the occurrence of VAP when administered as a single dosage during intubation. Numerous studies have demonstrated that, even though chlorhexidine remains in the mouth for around twelve hours, its antibacterial effects wear off after only seven hours of rinsing.<sup>16</sup> This backs up our findings that the frequency of ventilator-associated pneumonia is unaffected by the effectiveness of four-hourly or six-hourly chlorhexidine mouthwash. Oral care for intensive care unit patients was administered in our study by swabbing the oral mucosa for one minute with 30 ml of 0.2% chlorhexidine. According to the meta-analysis conducted by Cristina C. Villar et al., both 0.12% and 0.2% chlorhexidine were not shown to significantly reduce the incidence of VAP in adults.<sup>17</sup> It is dose-dependent that chlorhexidine exerts its antibacterial action. Studies have shown that 2% chlorhexidine has more potent and longer-lasting antibacterial effects than less concentrated versions.

## CONCLUSION

Reducing pneumonia caused by ventilators requires adequate oral hygiene treatment for ventilated patients in critical care. Our study found that patients in critical care who practice good oral hygiene by using chlorhexidine mouthwash

had a lower risk of developing pneumonia due to ventilator use. Regarding the frequency of pneumonia caused by ventilators, we did not find a difference between the effectiveness of four-hourly and six-hourly mouthwash with chlorhexidine.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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




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4	Amjad Nadeem	Data collection, Data entry.	
5	Miss Misbah Ashiq	Data collection, Data entry.	
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