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Original Article

Oral Care Practices for Mechanically Ventilated Patients in Intensive Care Units by Nursing Staff for Prevention of Ventilator Associated Pneumonia (VAP)

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ABSTRACT

Objective: To measure Beck oral care assessment score of ventilator dependent patients, and to estimate the knowledge of oral care practice of nursing staff.

Study Design: Cross-sectional study.

Place and Duration of the Study: Department of Intensive Care Unit (Medical, Surgical and CCU) Combined Military Hospital Sialkot, Pakistan from Oct 2024 to Mar 2025.

Methodology: Knowledge of 208 nurses and cadets assessed through a pre-validated questionnaire. The Beck oral assessment score was measured and correlated with frequency of ventilator associated pneumonia as well. The reasons behind the deviation from standard practice were also investigated.

Results: Out of 108 patients, 23(21.2%) developed ventilator associated pneumonia (VAP) and 85(78.8%) did not developed VAP. The VAP was seen in 5(4.6%) patients with moderate BOAS category and 18(16.6%) patients with severe BOAS category with p value of 0.005. Overall, knowledge was adequate in 186(89.4%) nurses and cadets combined and the most prevalent reason for deviation from standard of care was the shortage of nursing staff which was told by 139(66.8%) members of the group.

Conclusion: It was concluded that oral care practices for mechanically ventilated patients in intensive care units by nursing staff for prevention of ventilator associated pneumonia (VAP) are not adequate despite good knowledge due to shortage of staff, limitation of time, paucity of resources and lack of continuity of care.

Keywords: Intensive Care Unit, Knowledge, Nurse, Oral, Ventilator Associated Pneumonia (VAP).

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INTRODUCTION

Aspiration of oral colonizers because of poor oral practices is by far the most common and important cause of ventilator associated pneumonia (VAP), which is attributable to 60% of infection-related deaths in health care setups.[1,2] Nonetheless, the practice of oral care is neglected despite ample evidence on significance of oral care in prevention of VAP. Mucociliary defense mechanism is also compromised with endotracheal tube (ETT).[3] Disruption of normal mucus clearance and loss of cough mechanism causes collection of secretions above the cuff, which contaminates subglottic pool.[4] The risk of ventilator associated pneumonia escalates 3% per day of intubation and there is a six-to-twenty-fold higher risk of development of pneumonia compared to non-ventilated ICU. One reason behind this is negligence of oral hygiene of ventilated patients by nursing staff.[5]

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For maintenance of the stomatognathic system of ventilated ICU patients, oral hygiene is often precarious. Changes in salivary flow due to medications worsening the balance of oral flora.6 Biofilm on the tongue, dental plaques on the dental surface, coated tongue and periodontal disease offer a conducive environment for growth of gram-negative bacteria.[7]

Doctors and nurses in ICUs usually concentrate on life threatening issues and have little concern about issues like oral care. However, ineffective oral care practices lead to dental plaque deposits on the teeth within 72 hours which harbor potential respiratory pathogens, leading to VAP.[8] Tooth brushing along with standard oral care provides an additional advantage in the prevention of VAP in mechanically ventilated patients.[9] Studies show that tooth brushing is associated with lower rates of VAP in intubated mechanically ventilated critically ill patients.[10] The rationale of this study was to reduce the prevalence of VAP by creating awareness regarding this underrated and neglected part of intensive care.

METHODOLOGY

This cross-sectional study was conducted at the Intensive Care Units including Surgical, Medical and CCU settings of Combined Military Hospital Sialkot, Pakistan from October 2024 to March 2025, after approval from the Institutional Ethical Review Committee (ERC/23/2025 dated 25 September 2024).

Inclusion Criteria: Ventilator-dependent patients of either gender, and any age group admitted to the medical and surgical intensive care, and coronary care units, and nursing staff (senior nurses and nursing cadets) include senior nurses who had at least 2 years of clinical experience working in intensive care units, and nursing cadets who had had a three-month rotation of intensive care were included.

Exclusion Criteria: Patients with tracheostomy, those with Non-Ventilator Associated Pneumonia like aspiration pneumonia, and nursing staff and cadets not working in the ICU currently were excluded.

Sample size was estimated using WHO calculator keeping anticipated population proportion of patients that were liable to develop ventilator associated pneumonia with neglected oral care at standard prevalence. We collected a sample of 108 patients on ventilator who fulfilled criteria furnished and 208 sample of nursing staff (senior nurse and nursing cadets).

The patients included were those who were ventilator-dependent and oral assessment was started after 48 hours and then daily onward by using BOAS score.

The adequacy of oral care was quantified through Beck oral assessment score as shown in Table-I.[10] We included 108 ventilator dependent patients through non-probability consecutive sampling. Ventilator Associated Pneumonia (VAP) was defined as a combination of radiological, clinical and microbiological criteria in a patient who has been receiving mechanical ventilation for at least 48 hours.[11] Four categories of oral assessment were defined (score≤ 5: no dysfunction, score 6 to 10: mild dysfunction, score 11 to 15: moderate dysfunction, and score 16 to 20: severe dysfunction) based on Beck oral assessment score (BOAS). The BOAS score was calculated after 48 hours of mechanical ventilation, and then on a daily basis. The primary outcome was the frequency of BOAS categories based on BOAS score, and frequency of VAP and their comparisons. Other outcomes were the adequacy of knowledge of nursing staff regarding importance of oral care and the reason for deviation from standard practice. The knowledge of 208 nursing staff was assessed through validated questionnaire (Table-II) based on fundamental concepts as per literature and validated by 2 senior consultants. The knowledge of nursing staff was considered adequate if score was 5 or more, and inadequate or poor if score less than 5. Reasons for deviation from standard oral care were assessed by six parameters and their frequency of reasons for deviation of practice was also recorded.

Table-I: Beck Oral Assessment Score (BOAS)

	SCORE			
Condition of Lips, Gums & Oral Mucosa Tongue, Teeth & Saliva	Less than equal to 5	6 to 10	11 to 15	16-20
BOAS Category	No dysfunction	Mild dysfunction	Moderate dysfunction	Severe dysfunction

Table-II: Questions Assessing Knowledge of Nursing Staff and Reasons for Deviation from Standard Practice (n=208)

Knowledge of nursing staff regarding oral care
1. Is head elevation important for nursing care of ventilator-dependent patients?
2. Do subglottic secretions cause micro aspiration?
3. Does VAP have high mortality?
4. Does oral care prevent VAP?
5. Do you have adequate knowledge of focal theory of infection?
6. Do you have adequate knowledge of oral care steps as per hospitals SOP?
7. Should oral care be given by qualified nurses or ward boys?
Reason behind deviation from standard of care
1. Time limitation
2. Lack of continuity of care
3. Limited availability of supplies and equipment
4. Shortage of nursing staff
5. Lack of proper training
6. Perception of oral care being unpleasant

Data was analyzed through Statistical Package for Social Sciences (SPSS) version 24. The frequency of BOAS score categories was calculated and compared to frequency of ventilator associated pneumonia. The frequency of adequacy of knowledge and reason of deviation from standard practice was also calculated. Fisher's Exact Test was applied to compare association between BOAS categories with frequency of VAP. a *p*-value ≤0.05 was considered significant.

RESULTS

Out of 108 patients, 23(21.2%) developed ventilator associated pneumonia (VAP) in both intensive units and 85(78.8%) did not develop VAP. According to Beck oral assessment score (BOAS) score,

63(58.3%) patients had no dysfunction, 15(13.8%) had mild dysfunction, 8(7.4%) had moderate dysfunction and 22(20.35%) had severe dysfunction. VAP was seen in 5(4.6%) patients with moderate BOAS score, and 18(16.6%) with severe BOAS (p=0.00), as shown in Table-III.

Total nurses included in the study were 208. Their mean age was 29.04±4.86 years, as shown in Table-IV. There were 97(46.6%) nurses, and 111(53.4%) nursing cadets recruited for study. The overall knowledge of nursing staff was adequate in 186(89.4%) and inadequate in 22(10.6%). Out of nurses, 86(88.6%) had adequate knowledge and out of nursing cadets 100(90.1%) had adequate knowledge. The most prevalent reason for deviation from standard of care was the shortage of nursing staff, which was reported by 139(66.8%) nursing staff members. The second most prevalent answer was the time limitation, reported by 29(13.9%) nursing staff members. Twenty-five (12.0%) nurses implied that limited availability of supplies and equipment was a reason for deviation from oral care practices, and 15(7.2%) said that lack of continuity of care was the reason behind lack of proper oral care (Table-V).

Table-III: Association between Beck Oral Assessment Score (BOAS) Categories and Ventilator Associated Pneumonias (VAP) (n=108)

Beck Oral Assessment Score (BOAS) categories		No dysfunction n (%)	Mild dysfunction n (%)	Moderate dysfunction n (%)	Severe dysfunction n (%)	*p*-value
Ventilator associated pneumonia (VAP)	Yes	0 (0%)	0 (0%)	5 (4.6%)	18 (16.6%)	< 0.001
	No	63 (58.3%)	15 (13.8%)	3 (2.7%)	4 (3.7%)	

Table-IV: Demographics of Nurses under Study (n=208)

Mean Age in years, Mean ± SD		29.0 ±4.8
Categories of Nursing Staff	Nurses, n(%)	97(46.6%)
	Nursing cadets, n(%)	111(53.4%)

Table-V: Adequacy of Knowledge of Nursing Staff and Common Reasons of Deviation from Standard Care (n=208)

		n (%)
Knowledge of nursing staff	Adequate	186 (89.4)
	Inadequate	22 (10.6)
Reported reasons for deviation from standard care	Time limitation	29 (13.9)
	Lack of continuity of care	15 (7.2)
	Limited availability of supplies and equipment	25 (12.0)
	Shortage of nursing staff	(6.8)
	Lack of proper training	0 (0)
	Perception of oral care being unpleasant	0 (0)

DISCUSSION

This study revealed that patients with severe oral care dysfunction as per BOAS Criteria, exhibited a higher frequency of ventilators associated pneumonia (VAP). Although nursing staff had adequate knowledge regarding oral care, translation of care into practice was hindered by certain constraints, the most prevalent being the shortage of nursing staff, followed by lack of sufficient resources being a developing country. The cadets' had better knowledge of oral as compared to senior nurses. COVID-19 infection makes people more susceptible to developing VAP, partly but not entirely due to the increased duration of mechanical ventilation.[12] In this study, assessment of oral hygiene was done using BOAS, similar to Kelly *et al*.[13] We found that nurses' knowledge of oral care was good, but their practices were average when compared with cross-sectional study by Asadi.*et al*., who established that nurses had moderate knowledge of oral care, and their practices were rated higher than average.[14] Özel *et al*. gave an insight to factors which are responsible for disruption of oral care practices.[15] They advocated that the lack of proper training to be an important factor affecting the performance of oral care. Other important factors were time constraints, a high workload and shortage of equipment in contrast to our results. Another study by Dagnew *et al*. narrated the reasons behind the lack of quality oral care practice were inadequate equipment followed by absence of guidelines, and shortage of nurses, which was similar to our study.[16] According to Ashford *et al*., oral care should be adopted as a medical treatment for prevention of systemic diseases.[17] They also implied that oral hygiene is neglected in intensive care setups,

and they attributed this to poor staff training, lack of materials and lack of administrative support.

A study conducted at Lahore, Pakistan by Aziz et al. revealed that nurses had poor knowledge of ventilator bundle with mean score of 37.5%.[18] They came up with the idea of mismanagement on behalf of nurses as they did not delegate responsibilities, showed poor-self efficacy and time related barriers. Whereas in our study, both nurses and nursing cadets had good knowledge of the oral care practices in importance of intensive care but shortage of staff was a reason for neglect.

A simple measure as regular brushing of teeth can be phenomenal in saving the life of a ventilator dependent patient. Oral care speaks volumes, and its simplicity cannot overshadow its importance. Compulsory tooth brushing has prevented VAP, decreased length of stay in ICU and reduced time on ventilator.[19] Zambrano *et al*. performed a clinical trial where they used two different methods of oral care. They investigated an improvised toothbrush with suction for aspiration of saliva and cleaning of tooth. There was a reduction of the pathogenic buccal microbiota in mechanically ventilated patients receiving oral hygiene using a toothbrush as compared to suction with chlorhexidine gel.[20]

LIMITATIONS OF STUDY

The main limitation of our study is that it was conducted at a single center. More widespread studies can be conducted to highlight the importance of oral care and formulate national guidelines.

CONCLUSION

This study concludes that despite our nurses and nursing cadets having adequate knowledge of oral care practices, their practical implications remained below par and most probable causes highlighted includes shortage of staff, limitation of time, paucity of resources and lack of continuity of care.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

SU & TA: Conception, study design, drafting the manuscript, approval of the final version to be published.

OA & AK: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

AK & AQ: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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