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Original article

Efficacy of subglottic suctioning in reducing ventilator associated pneumonia among intubated patients

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Abstract

There are a limited number of Indian studies which evaluated the efficacy of subglottic suctioning in reducing the occurrence of ventilator associated pneumonia among intubated patients. **Aim**: To evaluate the efficacy of subglottic suctioning in reducing the occurrence of ventilator associated pneumonia. **Methodology:** This randomised controlled trial, was conducted in the Medical and Surgical Intensive Care Units. Twenty patients were enrolled, ten in the intervention and ten in the control group. Background variables, Clinical profile and Clinical Pulmonary Infection Score (CPIS) were evaluated. On admission the subjects, who met the inclusion criteria were randomised using lottery method to either intervention or control group. Pretest CPIS assessment was done for both the groups on the day of admission. Post-test CPIS assessment was carried out on the day of extubation or tracheostomy or when the subject had a temperature spike greater than 1020F. **Results:** There was a significant reduction in the occurrence of ventilator associated pneumonia among patients in the intervention group than in the control group ($P < 0.01$). **Conclusion:** The results confirmed that the implementation of subglottic suctioning is effective in reducing the occurrence of ventilator associated pneumonia among intubated patients.

Keywords: Endotracheal intubation, subglottic suctioning, ventilator associated pneumonia

Introduction

Ventilator Associated Pneumonia (VAP) develops in patients mechanically ventilated for more than 48 hours. VAP is one of the common nosocomial infections in ICU and is second most common cause of morbidity and mortality in the intensive care unit. The occurrence of VAP adds to the morbidity already present, increases length of ICU stay, hospital stay and even increases mortality. Most of the nosocomial pneumonia is ventilator associated.[1] Several issues associated with mechanical ventilation have been addressed to reduce the incidence of nosocomial pneumonia. Subglottic suction of secretions accumulated above the endotracheal tube cuff has been one of the methods proposed.

Aspiration is a potential hazard for the patient with an endotracheal tube. Oral intubation increases salivation and swallowing is difficult, causing pooling of secretions. These secretions get colonized by micro-organisms, can get aspirated into the trachea along the folds produced in the inflated cuff and produce nosocomial pneumonia. Proper oral hygiene, frequent oral suctioning and subglottic aspiration is very essential to prevent their transduction to lung tissue. This study was undertaken to study the effect of using subglottic suction in reducing the occurrence of nosocomial pneumonia.

Methodology

Twenty patients who were intubated orally and mechanically ventilated in the Surgical and Medical Intensive care unit in a large hospital of South

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How to cite this article: Arumugam Y, Sivakumar MN, Balasubramanian K. Efficacy of subglottic suctioning in reducing ventilator associated pneumonia among intubated patients. *Ind J Resp Care* 2016; 5(1): 687-90.

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India were enrolled for the study. The necessary permission was obtained from concerned authorities and ethical clearance was obtained from the ethical committee prior to the data collection. The study was conducted over a period of 6 weeks.

The criteria for inclusion were critically ill patients, of either gender, between 18 – 65 years, with medical/surgical problems, needing mechanical ventilation in any mode. They were also assessed using the clinical pulmonary infection score (CPIS) score which evaluated the possibility of pre-existing pneumonia.

The Clinical Pulmonary Infection Score is a standardised tool, developed by Pugin *et al.*[2] It is widely used in clinical research and in infection control audits. The maximum score is 12. A score ≥ 6 shows the presence of VAP. The CPIS has been found to have a reliability of r = 0.96.[3] The score has a sensitivity of 93%, a specificity and positive predictive value of 100%. The content validity was obtained from experts in the field of nursing and medicine. The parameters assessed were presence of fever, white cell count, oxygenation status using the PaO_2/FIO_2 ratio, tracheal secretions and infiltrates in the chest x-ray. Those with a score of < 6 were included in the study.

The exclusion criteria were patients having CPIS ≥ 6 within 48 hours of intubation, patients intubated at other hospitals and referred to this hospital, patients in whom frequent oral suctioning was contraindicated and patients with facial injury or who underwent faciomaxillary surgeries.

Ten patients were randomised to the interventional group and ten patients to the control group, selected by nonprobability convenient sampling technique on the basis of the set. The patients in the interventional group were intubated with a special endotracheal tube with a subglottic suctioning port. The subglottic lumen was connected to the suction apparatus with a minimal pressure of 20 mm of Hg for continuous aspiration of subglottic secretions until the patients were extubated or a tracheostomy was performed.

On the day of intubation, the patients were assessed and those with CPIS < 6 were selected as study participants. During the study period, if there was any spike of temperature > 102^0 F, the post-test CPIS was assessed. The occurrence of ventilator associated pneumonia was then determined in both groups.

Data collected also included age, gender, diagnosis of patient, indication for intubation, details of antibiotic therapy and nasogastric tube feeding.

SPSS version 20 has been employed for statistical analysis. The independent 't' test was used to compare the effectiveness of subglottic suctioning in reducing the occurrence of VAP between intervention and control group.

Results

The demographic data is given in *Table 1*. About half of the patients in both experimental and control group were young adults.

Table 1 explains the distribution of patients in interventional and control group according to age and sex.

Table 2 enumerates the various diagnoses, reasons for intubation and antibiotic therapy the patient was receiving. The majority of the subjects in both groups were intubated for airway protection.

All the subjects in both groups were receiving antibiotics. Sixty percent in the intervention group were receiving amoxicillin/clavulanate potassium, twenty percent received a combination of Piperacillin/Tazobactum and Tecoplanin, ten percent received Piperacillin/Tazobactam and ten percent received Cefuroxime. Among the control group 30% received Piperacillin/Tazobactam, 20% received Meropenem, 20% received Ceftriaxone, 10% received Cefuroxime and 20% received a combination of Piperacillin/Tazobactam, Teicoplanin and Meropenem.

Table 3 lists the occurrence of VAP in both groups. *Table 3* indicates the pretest CPIS of intervention and control group, which has a mean of 2.4 and 2.5 respectively. The obtained 't' value is 0.25, which is not significant. Thus homogeneity exists

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Table 1: Demographic data

	Variable	Intervention group (n = 10)	Control group (n = 10)
1.	Age in years [n (%)]		
	a) 18-45	6 (60)	5 (50)
	b) 46-60	2 (20)	3 (30)
	c) 61-80	2 (20)	2 (20)
2.	Sex [n (%)]		
	a) Male	6 (60)	9 (90)
	b) Female	4 (40)	1 (10)

Table 2: Description of subjects according to Clinical Variables N = 20

	Clinical variable	Intervention Group (10)	Control Group (10)
1.	Diagnosis		
	a) Neurologic disorders	2	2
	b) Respiratory disorders	0	1
	c) Cardiovascular diseases		
	d) Trauma	0	3
	e) Poisoning	3	2
	f) Others	2	2
2.	Reason for Intubation		
	a) Respiratory Failure	2	3
	b) Airway protection	6	4
	c) Haemodynamic instability	2	3
3.	Antibiotics		
	a) Narrow spectrum	7	3
	b) Broad spectrum	1	5
	c) Combination	2	2

Table 3: Comparison of occurrence of VAP using CPIS in pre and post-test among intubated subjects in Intervention and Control group N = 20

VAP	Pretest		Post-test	
	Intervention group	Control group	Intervention group	Control group
N	10	10	10	10
Mean	2.4	2.5	4.1	7.2
S.D	0.89	1.76	1.84	2.19
Independent 't' value	0.25 (NS)		4.99*	

P < 0.01 NS – Not significant

between the intervention and control group before starting the intervention. The control group has a higher mean (7.2) than intervention group (4.1). The obtained 't' value is 4.99 which is significant at 0.01 level. Thus the modified oral care protocol with subglottic suctioning is effective in reducing the occurrence of VAP among intubated subjects in the intervention group than the control group.

Discussion

Ventilator-associated pneumonia is an important nosocomial infection with a high incidence of morbidity and mortality. Subglottic suctioning of secretions is one of the several measures suggested to reduce the incidence of nosocomial pneumonia.

Lacherade *et al* determined the effect of subglottic secretion drainage (SSD) in reducing the incidence of microbiologically confirmed VAP.[4] In a randomised clinical trial they enrolled 333 patients, 169 in experimental group who received SSD and 164 in control group who did not receive SSD. The occurrence of VAP was confirmed microbiologically in 25 (14.8%) of intervention group and 42 (25.6%) of control group (p = 0.02). There was a remarkable reduction in the VAP rate in intervention group. This finding supports the present study result that there is significant reduction in VAP rate among the intervention group subjects who received subglottic secretion drainage.

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The present study was undertaken to evaluate the effect of its use in reducing nosocomial pneumonia. We found that there is a significant increase in the post-test mean of control group than intervention group, revealing that subglottic suctioning is effective in reducing the occurrence of VAP among intubated and mechanically ventilated patients. The important aspect of VAP prevention bundle is proper subglottic suctioning to those who are intubated and mechanically ventilated. The secretion pooled over the cuff in endotracheal tube is effectively drained by subglottic suctioning, which reduces the VAP rate. Our findings correlate with the recommendations for prevention of VAP.[5-7] The investigators could not identify any complication during the execution of subglottic secretion drainage.

Conclusion

Subglottic suctioning of secretions accumulated above the endotracheal tube reduces the VAP rate significantly. Continuous suctioning pressure should be frequently monitored to avoid tracheal mucosal damage. Further studies can evaluate the effectiveness of subglottic suctioning in reducing the development and duration of early and late VAP.

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