

The effect of implementing ventilator care bundle into practice among ventilator patients in critical care units of Dr. D.Y. Patil Hospital and Research Centre.

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Abstract

Background:

The aim of endotracheal tube (ETT) suctioning in patients under mechanical ventilation is keeping the airways open through removal of accumulated pulmonary secretions⁽¹⁾. Although ETT suctioning is a vital procedure, it may result in complications such as discomfort, infection, bleeding, tracheal mucosal injury, and increase in intracranial pressure, atelectasis, cardiac dysrhythmia, and hemodynamic changes in patients^(2,3)

Nowadays two methods are used for ETT suctioning. The most common method in Iran is open system suctioning method, which need participation of two nurses and may lead to temporary disruption of ventilation and oxygen supply due to disconnection of the patient from ventilation device during suctioning⁽⁴⁾. The most important risk factor in open method of ETT suctioning is hypoxia⁽⁵⁾. However, in the second method, which is known as closed suction system, ETT suctioning can be administrated through connections in closed suction set and while the ventilation is performing without disconnecting the patient from ventilator⁽⁶⁾.

Materials and methods: In this Quasi-experimental nonrandomized control group study, 60 patients with age group of 20-60 years on mechanical ventilation in critical care unit were taken using probability simple random sampling were randomly allocated into 2 groups of 30 patients each, Group A received oral care with open suctioning method and group B received oral care with close suctioning method. The onset and duration of ventilator associated complications was assessed in both the groups with ventilator associated complications checklist containing symptoms. Data received from both the groups were compared with the socio-demographic profiles and between the groups.

Results: Average ventilator associated complication score in open suction group was 23.5 which was 9.2 in closed suction group. Z-value for this test was 35.2 with 118 degrees of freedom. Corresponding p-value was small (less than 0.05), the null hypothesis is rejected. The ventilator associated complications score among closed suction group was significantly low as compared to that in open suction group.

Conclusion: Closed suction method was found effective in reducing the ventilator associated complications among the mechanically ventilated patients on ventilator when compared to open suction method oral care with open suctioning method.

Key words: Ventilator care bundle complications, open suctioning method, closed suctioning method, oral care.

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I. Introduction

Mechanical ventilation is an essential, life-saving therapy for patients with critical illness and respiratory failure. Studies have estimated that more than 300,000 patients receive mechanical ventilation in the United States each year [7-9]. These patients are at high risk for complications and poor outcomes, including death [7-11]. Ventilator-associated pneumonia (VAP), sepsis, Acute Respiratory Distress Syndrome (ARDS), pulmonary embolism, barotrauma, and pulmonary edema are among the complications that can occur in patients receiving mechanical ventilation; such complications can lead to longer duration of mechanical ventilation, longer stays in the ICU and hospital, increased healthcare costs, and increased risk of disability and death. The present study aims to identify the effectiveness of the suctioning methods in reducing the ventilator associated complications for mechanically ventilated patients.

II. Materials And Methods

An evaluative study with Quasi-experimental was carried out on patients with mechanical ventilation in critical care unit of Dr. D.Y. Patil Hospital and Research Center, Pimpri, Pune from August 2018 to August 2020

Study design: Quasi-experimental nonrandomized control evaluative study.

Study location: Dr.D.Y. Patil Hospital and Research Center, Pimpri, Pune

Study duration: August 2018 to August 2020

Sample Size: 60 patients

Sample Size Calculation: The sample size was estimated on the basis of number of subjects or units to be included in a study. It is required for appropriate analysis, desired level of accuracy of the data and allow validity of significance test. For the present study 60 patients who are mechanically ventilated and admitted in critical care unit.

For sample size Cochran's Formula was used.

$$\text{Sample size} = \frac{Z^2 \times p \times (1-P)}{m^2}$$

Where Z= Z score, p = population proportion, m= margin of error

Subject and selection method: The study population was selected those were fulfilling the inclusion criteria. Patients with age group of 20-60 years on mechanical ventilation in critical care unit were randomly allocated into 2 groups of 30 patients each, Group A received oral care with open suctioning method and group B received oral care with close suctioning method.

Inclusion criteria:

- 1) Patients age > 18 years
- 2) Patient developing complications within 48 hours after admission.

Exclusion criteria:

- 1) Patients with pneumonia prior to mechanical ventilation
- 2) Patient with pneumonia at the time of admission were excluded from the study
- 3) Patient undergone Oro-pharyngeal trauma or surgery.
- 4) Patient having known hypersensitivity to chlorhexidine.

Procedure methodology:

The investigator will approach the selected samples, inform them regarding the objectives of the study and obtaining their consent after assuring the confidentiality of the data. The investigator will perform implement ventilator bundle care by doing oral care with open suctioning to one group and oral care with closed suctioning to another group, then compare the results of both and can conclude the effect of implementation of ventilator bundle care and effectiveness of the suctioning methods among open and closed suction system. Total 60 patients with age group of 20-60 years on mechanical ventilation in critical care unit were taken using probability simple random sampling were randomly allocated into 2 groups of 30 patients each, Group A received oral care with open suctioning method and group B received oral care with close suctioning method.

Statistical analysis:

Data was analyzed on the basis of the objectives by using descriptive and inferential statistics. Fisher's exact test for association between the ventilator patients and selected demographic variables in open suction group and closed suction group. Two sample z-test for comparison of effect of open suction and closed suction ventilator care among ventilator patients Z-value for this test was 35.2 with 118 degrees of freedom. Corresponding p-value was small (less than 0.05)

III. Result

Description of samples (ventilator care patients in critical care units) based on their personal characteristics

Table 1: Description of samples (ventilator care patients in critical care units) based on their personal characteristics in terms of frequency and percentages.

Demographic variable	Open suction Group		Closed suction group	
	Freq	%	Freq	%
Age				
20-25 years	17	28.3%	18	30.0%
26-30years	27	45.0%	27	45.0%

31-35years	13	21.7%	12	20.0%
>35 years	3	5.0%	3	5.0%
Sex				
Male	36	60.0%	36	60.0%
Female	24	40.0%	24	40.0%
Hospitalization Reason				
Neurological injuries	10	16.7%	18	30.0%
Respiratory problems	22	36.7%	22	36.7%
Postoperative care	28	46.7%	20	33.3%
Length of stay in Intensive care unit				
More than 48 hours	60	100.0%	60	100.0%
Duration of mechanical ventilation				
Within 24 hours	28	46.7%	26	43.3%
Within 48 hours	32	53.3%	34	56.7%
Socio-economic status				
Middle class family	43	71.7%	39	65.0%
Higher class family	17	28.3%	21	35.0%
Clinical profile				
Tracheal culture	19	31.7%	25	41.7%
Sputum analysis	41	68.3%	35	58.3%

In open suction group, 28.3% of the patients had age 20-25 years, 45% of them had age 26-30 years, 21.7% of them had age 31-35 years and 5% of them had age more than 35 years. In closed suction group, 30% of the patients had age 20-25 years, 45% of them had age 26-30 years, 20% of them had age 31-35 years and 5% of them had age more than 35 years.

In open suction group, 60% of them were males and 40% of them were females. In closed suction group, 60% of them were males and 40% of them were females.

In open suction group, 16.7% of them were hospitalized for neurological injuries, 36.7% of them were hospitalized for respiratory problems and 46.7% of them were hospitalized for postoperative care. In closed suction group, 30% of them were hospitalized for neurological injuries, 36.7% of them were hospitalized for respiratory problems and 33.3% of them were hospitalized for postoperative care.

In open suction and closed suction groups, all of them had stay for more than 48 hours in intensive care unit.

In open suction group, 46.7% of them had mechanical ventilator within 24 hours and 53.3% of them had mechanical ventilator within 48 hours. In closed suction group, 43.3% of them had mechanical ventilator within 24 hours and 56.7% of them had mechanical ventilator within 48 hours.

In open suction group, 71.7% of them were from middle class family and 28.3% of them were from high class family. In closed suction group, 65% of them were from middle class and 35% of them were from higher class.

In open suction group, 31.7% of them had tracheal culture and 68.3% of them had sputum analysis. In closed suction group, 41.7% of them had tracheal culture and 58.3% of them had sputum analysis.



SECTION II:

Analysis of data related to the effect of implementing ventilator care among ventilator patients

Table 2: Effect of implementing ventilator care among ventilator patients

Ventilator Associated Complications	Open suction Group		Closed suction group	
	Freq	%	Freq	%
Mild (score 0-10)	0	0.0%	48	80.0%
Moderate (Score 12-21)	13	21.7%	12	20.0%
Severe (Score 22-32)	47	78.3%	0	0.0%
Extreme (Score 33-42)	0	0.0%	0	0.0%

In open suction group, 21.7% of the patients had moderate complications (score 12-21) and 78.3% of them had severe complications (22-32) associated to ventilator. In closed suction group, 80% of them had mild complications (score 0-10) and 20% of them had moderate complications (score 12-21) associated to ventilator. This indicates that the closed suction group has remarkably lesser complications associated to ventilator than those in open suction group.

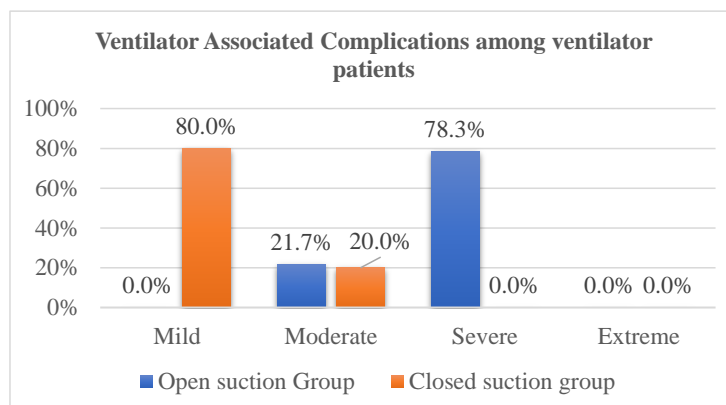
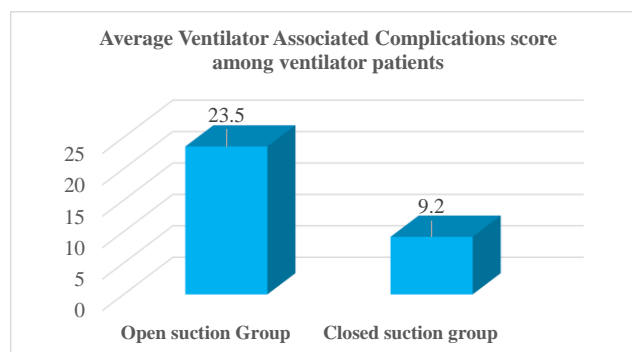


Table 3: Two sample z-test for comparison of effect of open suction and closed suction ventilator care among ventilator patients.

	Mean	SD	z	df	p-value
Open suction Group	23.5	2.5	35.2	118	0.000
Closed suction group	9.2	1.9			

Researcher applied two sample z-test for the comparison of ventilator related complications among patients on ventilator in open suction group and closed suction group. Average ventilator associated complication score in open suction group was 23.5 which was 9.2 in closed suction group. Z-value for this test was 35.2 with 118 degrees of freedom. Corresponding p-value was small (less than 0.05), the null hypothesis is rejected. The ventilator associated complications score among closed suction group was significantly low as compared to that in open suction group. It is evident that the ventilator associated complications improved significantly in closed suction as compared to that in open suction group. Hence, closed suction method is more effective than open suction method in reducing the ventilator associated complications among the patients on ventilator.



Analysis of data related to the association between the ventilator patients and selected demographic variables

Table 4: Fisher’s exact test for association between the ventilator patients and selected demographic variables in open suction group

Demographic variable	Ventilator Associated Complications		p-value
	Moderate	Severe	
Age	20-25 years	8	0.039
	26-30years	3	
	31-35years	2	
	>35 years	0	
Sex	Male	8	1.000
	Female	5	
Hospitalization Reason	Neurological injuries	4	0.280

	Respiratory problems	3	19	
	Postoperative care	6	22	
Duration of mechanical ventilation	Within 24 hours	7	21	0.755
	Within 48 hours	6	26	
Socio-economic status	Middle class family	10	33	0.740
	Higher class family	3	14	
Clinical profile	Tracheal culture	4	15	1.000
	Sputum analysis	9	32	

Since p-value corresponding to demographic variable Age was small (less than 0.05), the ventilator related complications were found to have significant association with age of the patients on ventilator care in open suction group.

Table 5: Fisher's exact test for association between the ventilator patients and selected demographic variables in closed suction group

Demographic variable		Ventilator Associated Complications		p-value
		Mild	Moderate	
Age	20-25 years	14	4	0.881
	26-30years	22	5	
	31-35years	10	2	
	>35 years	2	1	
Sex	Male	29	7	1.000
	Female	19	5	
Hospitalization Reason	Neurological injuries	14	4	1.000
	Respiratory problems	18	4	
	Postoperative care	16	4	
Duration of mechanical ventilation	Within 24 hours	21	5	1.000
	Within 48 hours	27	7	
Socio-economic status	Middle class family	30	9	0.513
	Higher class family	18	3	
Clinical profile	Tracheal culture	17	8	0.098
	Sputum analysis	31	4	

Since all the p-values are large (greater than 0.05), none of the demographic variable was found to have significant association with the ventilator related complications among the patients on ventilator care in closed suction group.

IV. Discussion

Suctioning is 'the mechanical aspiration of pulmonary secretions from a patient with an artificial airway in place. Closed suctioning offers benefits not found in the open procedure and can minimize the overall risks and complications associated with endotracheal suctioning. Closed suctioning is in keeping with current patient safety measures designed to lower the risk for patients of being exposed to potentially harmful bacteria. A closed suctioning device with integrated rinse port also allows healthcare workers to perform both suctioning and rinsing without opening the suction circuit, again reducing the possibility of cross-contamination for patients and caregivers alike. The reduced likelihood of exposure to potential infectious illnesses such as Ventilator Associated Pneumonia (VAP) may also help lower hospital time and expense associated with caring for VAP patients.⁽¹²⁾

Maggiore SM, Iacobone E, Zito G, Conti C, Antonelli M, Proietti R. conducted study closed versus open suctioning technique they concluded that the closed-suction system has some advantages compared to the

conventional, open-suction technique. It can be helpful in limiting environmental, personnel and patient contamination and in preventing the loss of lung volume and the alveolar derecruitment associated with standard suctioning in the severely hypoxemic patients. However, the impact of the closed system on ventilator-associated pneumonia as well as its cost-effectiveness and the influence of such devices with ventilatory support remain to be assessed⁽¹³⁾

In the present study both the group of patients receiving open suction method and group B receiving closed suction method. In open suction group, 21.7% of the patients had moderate complications (score 12-21) and 78.3% of them had severe complications (22-32) associated to ventilator. In closed suction group, 80% of them had mild complications (score 0-10) and 20% of them had moderate complications (score 12-21) associated to ventilator. In closed suction group symptoms like chest pain, dyspnea, purulent secretions, increased need of oxygen were reported less as compared to open suction group. This indicates that the closed suction group has remarkably lesser complications associated to ventilator than those in open suction group.

V. Conclusion

The closed suction group has remarkably lesser complications such as chest pain, purulent secretions, dyspnea, dry mouth and increased need of oxygen during and after the suctioning procedure as compared to open suction group.

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