

A Comparative Study to Assess the Effectiveness of Endotracheal Suctioning with and without Normal Saline Instillation in Terms of Physiological Parameters and Patient Outcome Measures among Mechanically Ventilated Patients in Selected Hospital of New Delhi

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Abstract

Introduction: Intubated patients are unable to cough sufficiently to remove pulmonary secretion. Nurses occasionally encounter thick and tenacious secretions during endotracheal (ET) suctioning. To manage these secretions, normal saline instillation (NSI) is used throughout the world. The use of NSI before endotracheal suctioning is intended to lubricate the catheter, liquefy and soften secretions, and stimulate coughing. The objectives of the study were to assess the effectiveness of endotracheal suctioning with normal saline instillation in terms of physiological parameters and patient outcome among mechanically ventilated patients; to assess the effectiveness of endotracheal suctioning without normal saline instillation in terms of physiological parameters and patient outcome among mechanically ventilated patients; and to compare the effectiveness in terms of physiological parameters and patient outcome in mechanically ventilated patients with and without normal saline instillation.

Methods: A quantitative research approach with comparative descriptive design was used for the study. The study was conducted in Max Super specialty Hospital, Saket and New Delhi. Purposive sampling was used for selecting 60 mechanically ventilated patients, from which 30 had undergone ET suctioning with normal saline instillation and 30 had undergone ET suctioning without normal saline instillation. Physiological parameters were assessed by using an observation checklist. Patient outcomes were assessed through observations made at 0–72 hours.

Results: The significant findings of the study revealed that mechanically ventilated patients, who had undergone ET suctioning with NSI in comparison to patients who had undergone ET suctioning without NSI, were significant in terms of ventilator tidal volume at 18 hours, p value was 0.005 (p_1), similarly systolic blood pressure at 6 hours and 12 hours were 0.001 and 0.049 respectively, significant at 0.05 level of significance. p value of temperature at 12 hours was 0.031, p values of ABG PaO₂ at 0 hour, 6 hours, 12

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hours and 18 hours were 0.036, 0.005, 0.022 and 0.043 respectively, significant at 0.05 level of significance, p values of ABG Na⁺ at 6 hours and 12 hours were 0.003 and 0.001 respectively, significant at 0.05 level of significance, p values of ABG K⁺ at 6 hours were 0.046, p values of ABG Ca⁺⁺ at 0 hour and 12 hours were 0.044 and 0.045 which were significant at 0.05 level respectively; however, the p₂ value calculated by ANOVA test from 0–72 hours of patient outcome was not significant at 0.05 level of significance.

Conclusion: The findings of the present study conclude that normal saline instillation while ET suctioning was effective in comparison to ET suctioning without normal saline instillation among mechanically ventilated patients in terms of respiratory parameters.

Keywords: Assessment, Effectiveness, Mechanically ventilated patients, ET suctioning, Normal saline instillation, Physiological parameter, Patient outcome

Introduction

The use of isotonic (0.9%) sodium chloride/normal saline instillation (NSI) prior to endotracheal suction in intubated patients has been widely practiced for over two decades in intensive care units throughout the world.¹ The purpose of instillation has been to increase sputum yield by diluting and loosening thick secretions, lubricating the suction catheter, enhancing cough stimulation and secretion mobilization, thus increasing secretion clearance.²

The variability of pathophysiology between patients requiring mechanical ventilation and the potential adverse effects of the procedure require that suctioning be customized to the individual patient. Suctioning results into changes in certain physiological parameters that are referred to monitor the baseline physiological variables such as respiratory, ventilator, cardiovascular, and neurological parameters before and after endotracheal suctioning in mechanically ventilated patients. Respiratory parameters includes breath sounds, secretions, arterial blood gases (pH, PaO₂, PaCO₂, HCO₃, BE, SpO₂, Na⁺, K⁺, Ca⁺⁺, lactate) and Chest X-ray. In ventilator settings, saw tooth pattern, tidal volume, and peak airway pressures are observed. For cardiovascular status, ECG heart rate, ECG rhythms, blood pressure, and mean arterial pressure are included. In neurological status, intra-cranial pressure is observed.³

Critically ill patients often have an increase in the production of mucous and an impaired ability to clear secretions. If secretions are not cleared effectively then the patient may be at risk of infection, atelectasis and alveolar collapse.⁴ Appropriate management of the patient with an artificial airway can have an impact on reducing complications (such as the development of ventilator-associated pneumonia (VAP), length of ICU stay, duration of mechanical ventilation, mortality, and morbidity.^{5,6}

Tracheal suction is required to maintain a patent airway and assist with preventing hypoxia, infection and atelectasis from retention of sputum. Complications such as hypoxia, cardiac dysrhythmias and mucosal damage have been associated with tracheal suctioning.⁷

Kleinpell provided a commentary about Caruso and colleagues' study findings, noting that evidence from a vast number of research studies showed that the routine use of normal saline instillation prior to suctioning is not a recommended practice for mechanically ventilated patients. The findings from Caruso and colleagues are significantly different from the results of other studies and must be cautiously interpreted because of a number of limitations, such as the use of an oncology patient population that are different from the general ICU patients with regard to the occurrence of VAP, pretreatment of antibiotics, immune-suppression and mortality. Kleinpell calls for further research before this practice can be recommended for routine use in ICU patients.⁸

Hagler and Traver found that a 5-mL normal saline instillation dislodged up to 310,000 of viable colonies of bacteria. The potential risk for infection that is caused by dislodging the bacteria into lower respiratory tract is added evidence that the routine use of normal saline instillation when suctioning should not be performed.⁹

Normal saline instillation in preparation to suctioning the airway is commonly used to help remove thick respiratory secretion; however, Christensen et al. reported that the use of saline can damage the antimicrobial properties of respiratory secretions. Their findings suggest that nasal and tracheal secretions and saliva have natural antimicrobial properties that can be damaged by instilling concentrations of sodium and chloride in normal saline.¹⁰

Materials and Methods

Keeping in view the nature of the problem and objectives of the present study, quantitative research approach was adopted and research design for the study was non-experimental comparative descriptive research design.

In the present study, sampling technique was purposive sampling technique, sample was mechanically ventilated patients and the sample size was 60 mechanically ventilated patients in ICU of Max Super specialty Hospital, Saket, New Delhi. Inclusion criteria included patients aged above

18 years, patients who were mechanically ventilated by endotracheal tube, patients who had been on mechanical ventilator for less than or up to 72 hours and hemodynamically stable, and consent was taken from relatives. Exclusion criteria included patients with positive sputum AFB prior to intubation, patients with preexisting respiratory disease, namely, COPD, TB, ILD, asthma, pneumonia, pulmonary malignancies and tumors and patients on chemotherapeutic drugs. Final data was collected from intensive care units of Max Super specialty Hospital, Saket, New Delhi. Data was collected for 20 days after screening the subjects based on inclusion and exclusion criteria of the study. Subjects were assured for confidentiality of their data. In order to ensure the validity of the structured observation and assessment checklist (parts I, II and III), the tools were given to 11 experts from the field of Medical Surgical Nursing specialized in CTVS and critical care nursing, nursing administration,

anesthesiology, critical care medicine and members of the infection control committee. The tool was found to be valid. The reliability of the tool was checked using inter-rater reliability of procedures related to physiological parameters and ET suctioning with and without normal saline instillation. Five experts were chosen from the field of nursing services, Nursing education and nursing administration. The calculated inter-rater reliability was 0.9, which indicates high degree of consistency between assigned scores of the procedures. Ethical approval was sought from Institutional Review Board, Jamia Hamdard and permission for the study was sought from the administrative authorities of Max Hospital, Saket, New Delhi.

Results

The findings of the study are presented as follows:

Section 1: Findings related to the Demographic Characteristics of the Sample

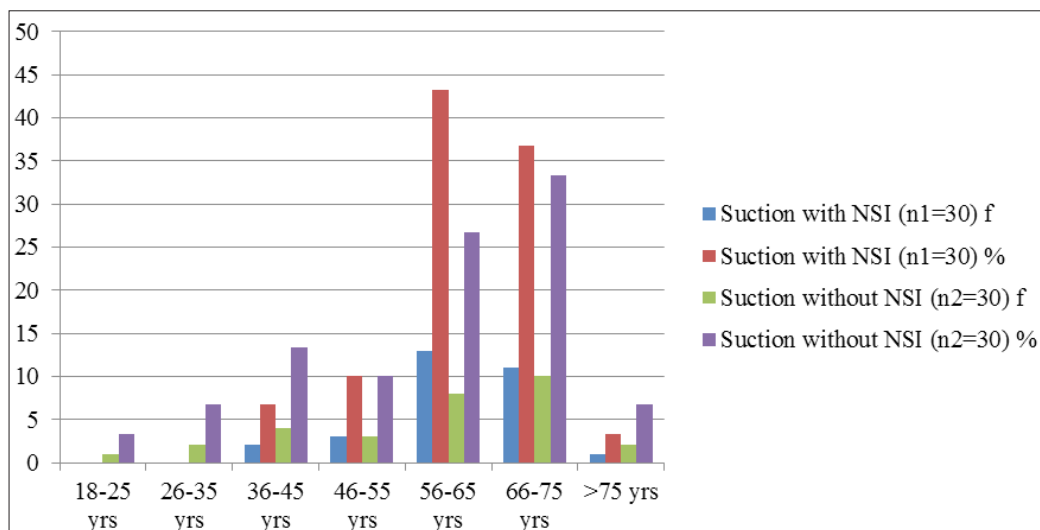


Figure 1.A Bar Graph Representation of Sample according to their Age in Years

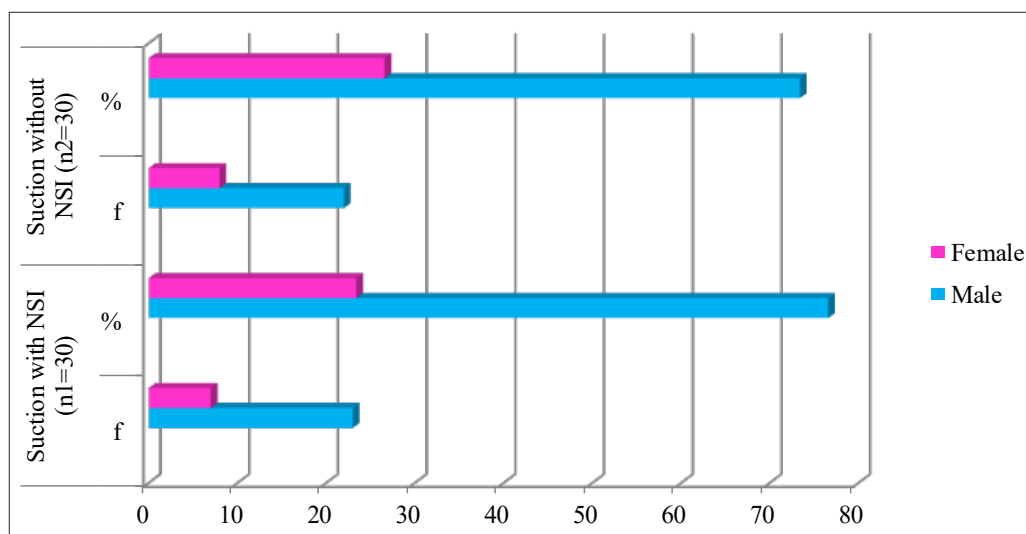


Figure 2.A Bar Graph Representation of Sample according to Their Gender

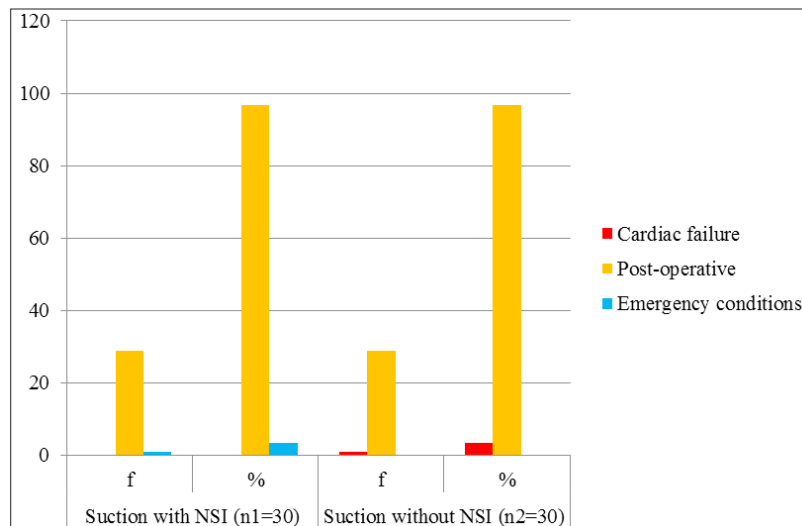


Figure 3.A Bar Graph Representation of Sample according to the Reason for Intubation

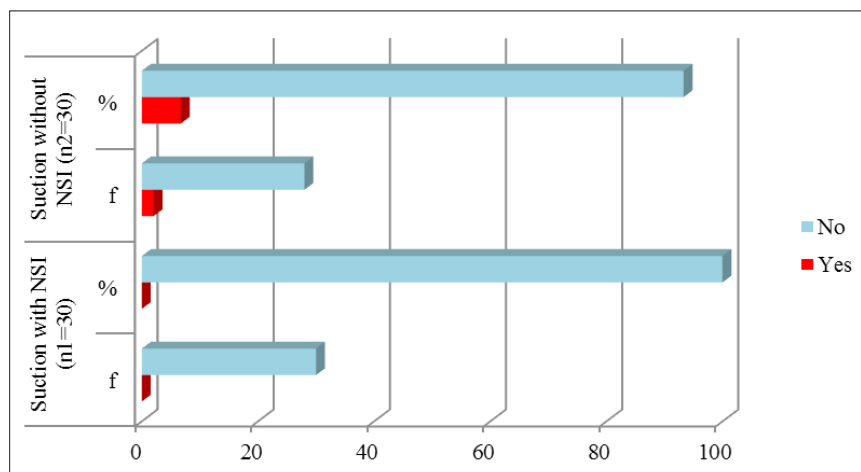


Figure 4.A Bar Graph Representation of Sample according to Their Intubation Status

Section 2: Comparison of Patients Outcome as per Physiological Parameters

Comparison of patients' outcome as per physiological parameters was calculated by t-test, p_1 value within 0–18

hours and p_2 value calculated by two-way ANOVA within 0–72 hours among mechanically ventilated patients had undergone ET suctioning with and without normal saline instillation (Table 1).

Table 1. Comparison of Patients' Outcome as per Physiological Parameters among Mechanically Ventilated Patients Who Had undergone ET Suctioning with and without Normal Saline Instillation

S. No.	Patient Outcome	Suction with NSI ($n_1=30$)	Suction without NSI ($n_2=30$)	p_1 value			
				0	6	12	18
1	Breath sounds	0–18 hrs category 3	0–72 hrs category 3	1.0	0.317	0.205	0.566
2	ET Secretion color	0–18 hrs category 3	0–72 hrs category 3	0.568	0.818	0.656	0.565
3	ET Secretion amount	0–18 hrs category 1,2,3	0–72 hrs category 1,2,3	0.317	0.568	0.648	0.339
4	Ventilator tidal volume	0.392	1.00	0.336	0.069	0.202	0.005*
5	Ventilator PAP	0.469	0.758	0.780	0.691	0.923	0.539
6	Ventilator PEEP	0.733	0.446	0.827	0.977	0.298	0.840
7	Ventilator FiO_2	0.845	0.028*	0.655	0.478	0.894	0.5644
8	Ventilator I:E	0–18 hrs category 3	0–72 hrs category 3	NA	NA	NA	NA

$n_1+n_2=60$

9	Heart rate		0.284	0.912	0.128	0.265	0.703	0.569
10	Blood pressure	SBP	0.320	0.561	0.113	0.001*	0.049*	0.064
		DBP	0.830	0.239	0.494	0.918	0.957	0.729
11	Temperature		0.270	0.207	0.093	0.098	0.031*	0.051
12	Chest X-ray		0-18 hrs category 3	0-72 hrs category 3	0.647	0.413	0.108	0.191
13	ABG pH		0.762	0.702	0.517	0.130	0.667	0.613
14	ABG PaO ₂		0.033*	0.365	0.036*	0.005*	0.022*	0.043*
15	ABG PCO ₂		0.782	0.919	0.681	0.604	0.040*	0.723
16	ABG HCO ₃		0.948	0.576	0.663	0.375	0.484	0.539
17	ABG BE		0.704	0.375	0.627	0.968	0.235	0.395
18	ABG Anion gap		0.724	0.832	0.492	0.802	0.273	0.710
19	ABG SpO ₂		0.292	0.124	0.217	0.162	0.111	0.233
20	ABG Na ⁺		0.781	0.232	0.184	0.003*	0.001*	0.070
21	ABG K ⁺		0.675	0.717	0.716	0.046*	0.101	0.194
22	ABG Cl ⁻		0.654	0.673	0.564	0.270	0.079	0.526
23	ABG Ca ⁺⁺		0.392	0.890	0.044*	0.179	0.045*	0.956
24	ABG lactate		0.411	0.727	0.059	0.197	0.220	0.793
25	ABG RBS		0.115	0.074	0.889	0.713	0.224	0.305

Data presented in Table 1 shows the comparison of patients' outcome as per physiological parameters calculated by t-test p₁ value within 0–18 hours. The p values for ventilator tidal volume at 18 hours was 0.005, for SBP at 6 hours, it was 0.001, at 12 hours it was 0.049, significant at 0.05 level. The p value temperature at 12 hours was 0.031, for ABG PaO₂ at 0 hour, it was 0.036, at 6 hours it was 0.005, at 12 hours it was 0.022, at 18 hours it was 0.043, for ABG Na⁺ at 6 hours, it was 0.003, at 12 hours it was 0.001, for ABG K⁺ at 6 hours, it was 0.046, for ABG Ca⁺⁺ at 0 hour, it was 0.044, at 12 hours it was 0.045, which were significant at 0.05 level. However, these patient outcomes were not significant within 0–72 hours, p₂ value calculated by ANOVA test, at 0.05 level.

Apart from this, p₂ value within 0–72 hours was calculated by two-way ANOVA among mechanically ventilated patients

who had undergone ET suctioning with normal saline instillation where p values for ET secretions were 0.003, for ABG PaO₂, it was 0.033, which were significant at 0.05 level among patients who had undergone ET suctioning with normal saline; this concludes that normal saline instillation is effective to decrease ET secretions and improve PaO₂ levels among mechanically ventilated patients.

P₂ value within 0–72 hours was calculated by two-way ANOVA among mechanically ventilated patients who had undergone ET suctioning without normal saline instillation where P₂ value for ventilator FiO₂ was 0.028, significant at 0.05 level among patients who had undergone ET suctioning without normal saline; this concludes that normal saline instillation is not effective and has increased the demand of FiO₂ resulting into prolonged ventilation among mechanically ventilated patients.

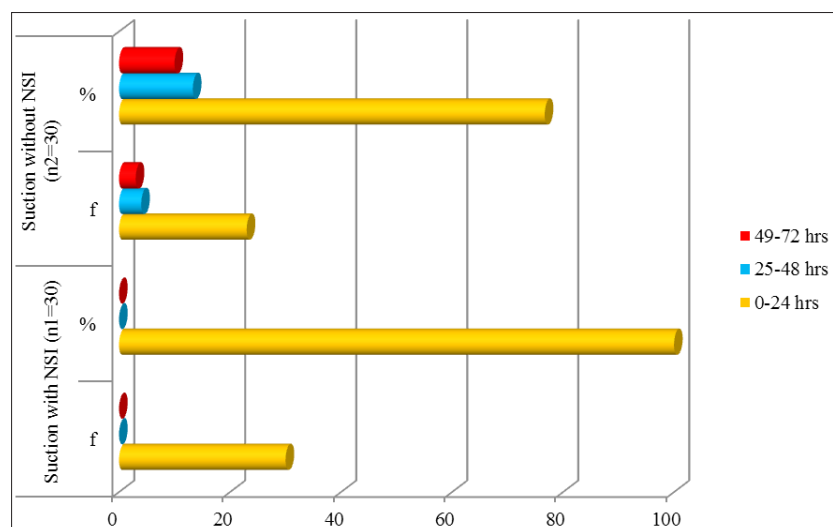


Figure 5.A Bar Graph Representation for Comparison of Ventilator Days

Time range-wise frequency and percentage distribution of patients' outcome (ventilator hours) among mechanically ventilated patients who had undergone ET suctioning with and without normal saline instillation is shown in Figure 5.

Discussion

Findings of the study have been discussed in terms of objectives and theoretical basis. In this section, major findings of the present study have been discussed with reference to the results obtained by other investigators. The present study was aimed to assess and compare the level of effectiveness of endotracheal suctioning with and without normal saline instillation in terms of physiological parameters and patient outcome measures among mechanically ventilated patients in a selected hospital of New Delhi. Hagler and Traver,⁹ had found that a 5-mL normal saline instillation dislodged up to 310,000 of viable colonies of bacteria.

The potential risk for infection that is caused by dislodging the bacteria into lower respiratory tract is added evidence that the routine use of normal saline instillation when suctioning should not be performed.⁹ However, in this study, ET secretions have shown positive results with >30 colonies with identified one-gram negative bacteria pathogen after 30–42 hours among mechanically ventilated patients who had undergone ET suctioning without normal saline instillation. A protocol should be developed in nursing services for use of normal saline while ET suctioning which includes 8 mL one-time-use for each suction. Education regarding techniques of suctioning and its related complications or deleterious effect of suctioning should be taught to the nurses.

No attempt was made to assess the course of antibiotics use and its duration. An antibiotic given prior to intubation to treat any secondary disorder or after intubation as post-operative prophylaxis was not considered in the present study. Use of antibiotics and their duration can affect in preventing, and simultaneously treating the clinical condition may change the physiological parameters in mechanically ventilated patients. Use of bronchodilators and nebulization was not assessed to make any changes in physiological parameters and patients' outcome in mechanically ventilated patients, which can affect oxygen saturation in such patients.

Conclusion

The study concludes that normal saline instillation was found to be effective while endotracheal suctioning of mechanically ventilated patients. It is suggested that nurses, doctors and physiotherapists must instill normal saline while endotracheal suctioning. Similar studies can be conducted

on larger sample size of mechanically ventilated patients of different hospitals for generalization of the findings. An experimental study can be conducted to assess the attempts of ET suctioning with and without NSI.

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Conflict of Interest: None

References

1. Çelik SA, Kanan N. A current conflict. Use of isotonic sodium chloride solution on endotracheal suctioning in critically ill patients. *Dimensions of Critical Care Nursing* 2006; 25: 11-14.
2. Raymond S. Normal saline instillation before suctioning. Helpful or harmful? A review. *American Journal of Critical Care* 1995; 4: 267-71.
3. Rolls K, Smith K, Jones P et al. Suctioning an adult with a tracheal tube. Penrith: Intensive care coordination & monitoring unit (ICCMU) & NSW health. 2007.
4. Day T, Farnell S, Wilson-Barnett J. Suctioning: A review of current research recommendations. *Intensive and Critical Care Nursing* 2002; 18(2): 79-89.
5. AACN. AACN Practice Alert Ventilator Associated Pneumonia. 2008.
6. Jelic S, Cunningham JA, Factor P. Clinical review: Airway hygiene in the intensive care unit. *Critical Care* 2008; 12(2): 209.
7. AARC. AARC Clinical Practice Guidelines. Endotracheal suctioning of mechanically ventilated patients with artificial airways. *Respiratory Care* 2010; 55(6): 758-64.
8. Kleinpell R. Use of normal saline instillation with suctioning: The debate continues. *Critical Care Alert* 2009; 17(1): 1-2.
9. Hagler D, Traver G. Endotracheal saline and suction catheters: Sources of lower airway contamination. *American Journal of Critical Care* 1994; 3(6): 444-47.
10. Christensen R, Henry E, Eggert L. Endo-tracheal al. A low-sodium solution for airway care: Results of a multicenter trial. *Respiratory Care* 2010; 55(12): 1680-85.

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