

# A Study to Evaluate the Effectiveness of Nurses Led Suctioning Protocol on Airway Clearance Among Intubated Patients Admitted in Nmch Jamuhar.

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## **Abstract—Background of the Study**

Endotracheal intubation in Intensive Care Units (ICUs) is a life-saving procedure for patients with acute respiratory failure. However, it disrupts normal airway clearance, leading to secretion accumulation, atelectasis, ventilator-associated pneumonia (VAP), and hypoxemia. Inconsistent and non-standardized suctioning practices may further cause complications such as hypoxia, mucosal trauma, and ineffective secretion removal.

## **Aim of the Study**

The study aimed to evaluate the effectiveness of a nurse-led suctioning protocol on airway clearance among intubated patients admitted to the ICU of Narayan Medical College and Hospital (NMCH), Jamuhar, Bihar.

## **Objectives of the Study**

The objectives were to compare pre-test and post-test airway clearance levels between study and control groups, evaluate the effectiveness of the nurse-led suctioning protocol, and determine the association between airway clearance and selected demographic and clinical variables.

## **Methodology**

A true experimental pre-test post-test control group design was used. Thirty intubated patients on mechanical ventilation for more than 48 hours were selected, with 15 patients each in the study and control groups. The study group received a nurse-led suctioning protocol based on evidence-based practices, while the control group received routine care. Airway clearance was assessed using a structured checklist.

## **Results**

Pre-test findings showed that most patients had mild to moderate airway clearance in both groups. After intervention, 93.3% of patients in the study group achieved effective airway clearance, compared to 13.3% in the control group. The mean airway clearance scores significantly increased from  $35.4 \pm 8.2$  to  $82.4 \pm 5.5$  in the study group ( $p < 0.001$ ). Significant association was found with diagnosis and duration of mechanical ventilation.

## **Conclusion**

The nurse-led suctioning protocol was effective in improving airway clearance among intubated patients. It supports standardized nursing practice and may help reduce complications such as VAP, atelectasis, and hypoxemia.

**Index Terms**—Airway clearance, Endotracheal suctioning, Nurse-led suctioning protocol, Intubated patients, Mechanical ventilation, ICU.

## I. INTRODUCTION

Endotracheal intubation is a critical intervention for patients with acute respiratory failure admitted to Intensive Care Units (ICUs). Although it is life-saving, it significantly disrupts the normal airway clearance mechanism, leading to the accumulation of secretions that impair ventilation and increase the risk of complications such as ventilator-associated pneumonia (VAP), atelectasis, and hypoxemia.<sup>1</sup> Intubated patients commonly suffer from comorbid conditions such as sepsis, trauma, and infections,

which are further aggravated by environmental factors like humidity and dust. These conditions contribute to the retention of thick secretions in the lower airways, creating a major challenge for nursing personnel working in resource-limited ICUs with heavy patient loads.<sup>2</sup>

Nurse-led suctioning protocols help standardize secretion removal through evidence-based practices such as pre-oxygenation, aseptic suctioning techniques, controlled suction pressure, and limited suction duration. These protocols enable nurses to identify clinical signs including audible gurgling, visible secretions in tubing, and increased peak inspiratory pressure, allowing timely interventions to maintain airway patency while minimizing complications such as mucosal trauma, hypoxia, and bradycardia.<sup>3</sup>

Globally, inconsistent suctioning practices are associated with nearly 40% of ventilator-associated pneumonia cases, one of the most common healthcare-associated infections among mechanically ventilated patients. Mortality rates related to VAP remain high, especially in developing countries, often exceeding 20%. Standardized suctioning protocols can therefore reduce ventilator days, ICU stay, healthcare costs, and improve patient outcomes.<sup>4</sup>

Airway clearance becomes further compromised because the endotracheal tube bypasses the upper airway's natural humidification, cough reflex, and mucociliary clearance system. This results in thick and dehydrated secretions that obstruct the endotracheal tube and bronchi, increase airway resistance, promote bacterial biofilm formation, and lead to ventilation-perfusion mismatch, causing hypoxemia and hypercapnia.<sup>5</sup>

## II. NEED OF THE STUDY

Intubated patients admitted to Intensive Care Units (ICUs) experience persistent airway clearance problems because endotracheal tubes bypass natural airway defense mechanisms such as the mucociliary escalator and cough reflex. This leads to secretion accumulation, increasing the risk of ventilator-associated pneumonia (VAP), atelectasis, and hypoxemia. Current standard suctioning practices are often inadequate in completely removing secretions and biofilms, as demonstrated by *in vivo* optical coherence tomography studies.<sup>6</sup>

Variations in nursing suctioning techniques, including inadequate pre-oxygenation, excessive negative pressure, and routine saline instillation, may contribute to complications such as hypoxia and mucosal trauma. Studies report that hypoxia occurs in nearly 15–25% of suctioning procedures, emphasizing the need for standardized suctioning protocols to improve patient safety and effectiveness of care.<sup>7</sup>

Although endotracheal suctioning is considered a cornerstone intervention in ICU care, observational studies indicate that routine suctioning methods often fail to adequately clear the endotracheal tube lumen. Residual biofilms are strongly associated with VAP rates ranging from 20–50%, especially among patients receiving mechanical ventilation for more than 48 hours. These findings highlight the need for nurse-led suctioning protocols that optimize secretion removal and reduce infection risk.<sup>8</sup>

Pre-intervention audits have further shown that nurses follow only 40–52% of recommended evidence-based suctioning practices, including limiting suction duration to 10–15 seconds and maintaining aseptic no-touch technique. These gaps in knowledge and clinical practice can potentially be improved through structured protocol-based training and implementation.<sup>9</sup>

The clinical and economic burden of VAP remains substantial, contributing to prolonged ICU stays by 5–10 days and mortality rates of up to 40%. Previous quasi-experimental studies have demonstrated that implementation of standardized suctioning protocols significantly reduced VAP rates from 35.2 to 15.87 per 1000 ventilator days and improved nurse compliance from 52% to 77%.<sup>10</sup>

### Title Of Study

A study to evaluate the effectiveness of nurses led suctioning protocol on airway clearance among intubated patients admitted in NMCH Jamuhar.

### Objectives

1. To assess and compare the pre-test level of airway clearance among intubated patients admitted to the Intensive Care Unit (ICU) between the study and control groups.
2. To assess and compare the post-test level of airway clearance among intubated patients admitted to the Intensive Care Unit (ICU) between the study and control groups.

3. To evaluate the effectiveness of the nursing-led suctioning protocol on airway clearance among intubated patients admitted to the Intensive Care Unit (ICU) in the study group.
4. To determine the association between the pre-test and post-test levels of airway clearance among intubated patients and their selected demographic and clinical variables in both the study and control groups.

#### Hypothesis

RH<sub>1</sub>: There is no significant difference in the pre-test level of airway clearance among intubated patients between the study and control groups.

RH<sub>2</sub>: There will be a significant difference between the pre-test and post-test levels of airway clearance among intubated patients in the study group.

RH<sub>3</sub>: There will be a significant difference in the post-test level of airway clearance among intubated patients between the study and control groups.

RH<sub>4</sub>: There will be a significant association between the post-test level of airway clearance among intubated patients and their selected socio-demographic and clinical variables such as age, gender, diagnosis, and duration of mechanical ventilation in the study group.

### III. METHODOLOGY

#### Research Approach

A quantitative evaluative research approach was used to assess the effectiveness of the nursing-led suctioning protocol on airway clearance among intubated patients.

#### Research Design

A true experimental pre-test post-test control group design was adopted for the study.

#### Research Setting

The study was conducted in the Intensive Care Units (ICUs) of Narayan Medical College and Hospital (NMCH), Jamuhar, Bihar.

#### Research Variables

##### Independent Variable

Nursing-led suctioning protocol

##### Dependent Variable

Airway clearance status among intubated patients

##### Extraneous Variables

Age, diagnosis, duration of intubation, level of sedation, and respiratory infection.

#### Population And Sample

The target population included adult intubated patients receiving mechanical ventilation for more than 48 hours.

The sample consisted of 30 intubated patients, with 15 patients in the study group and 15 in the control group.

#### Sampling Technique

Simple random sampling was used for selecting patients, and universal sampling was used for selecting eligible ICU nurses.

#### Inclusion Criteria

##### Patients

- Age 18 years and above
- Mechanically ventilated for  $\geq 48$  hours
- Admitted in selected ICUs
- Hemodynamically stable

##### Nurses

- GNM/B.Sc. Nursing qualified
- Minimum 6 months ICU experience
- Involved in endotracheal suctioning

#### Exclusion Criteria

##### Patients

- Neuromuscular disorders
- Bronchopleural fistula
- Extubated within 72 hours

##### Nurses

- Less than 6 months ICU experience
- Recent formal suctioning training
- Not involved in suctioning procedures

### IV. DATA COLLECTION PROCEDURE

After obtaining ethical clearance and permission from hospital authorities, pre-test assessment was conducted. Nurses in the study group received training on the nursing-led suctioning protocol. Post-test assessment was done after implementation of the intervention.

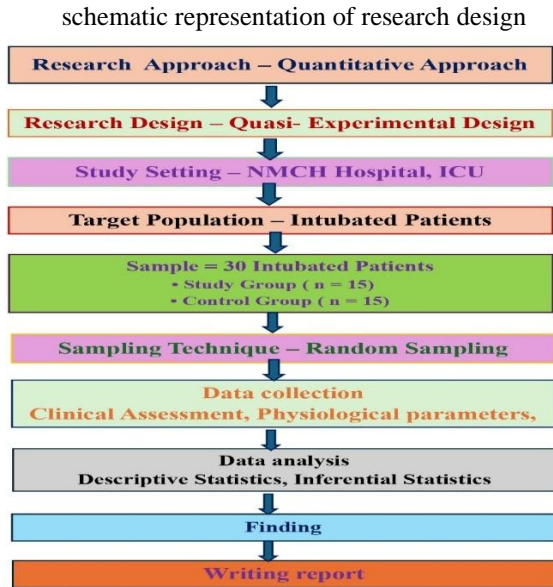


Fig no. 3.2 Schematic representation of methodology

V. PLAN FOR DATA ANALYSIS

The collected data will be analysed using descriptive and inferential statistics.

Descriptive Statistics: - Frequency and percentage for demographic variables.

Mean and standard deviation for airway clearance scores and knowledge scores

Inferential Statistics: - Paired t-test to compare pre-test and post-test scores within groups

Independent t-test to compare experimental and control groups.

Chi-square test to find association between airway clearance outcomes and selected demographic variables.

Intervention

Nursing-Led Suctioning Protocol

The intervention consisted of a structured nursing-led suctioning protocol for intubated patients admitted in the ICU. Nurses in the study group were trained to follow evidence-based suctioning practices. The protocol included patient assessment before suctioning, hand hygiene, aseptic technique, pre-oxygenation with 100% oxygen for 30–60 seconds, use of sterile suction catheter, controlled suction pressure (100–150 mmHg), and limiting suction duration to 10–15 seconds. Patient condition and physiological parameters such as SpO<sub>2</sub>, heart rate, and breath sounds were monitored before, during, and after

suctioning. The study group received the intervention during routine care, while the control group received routine hospital practices.

VI. DATA ANALYSIS

The collected data were analysed using descriptive and inferential statistics to evaluate the effectiveness of the nurse-led suctioning protocol on airway clearance among intubated patients.

Descriptive Statistics

- Frequency and percentage distribution were used to describe the demographic and clinical variables of the patients.

- Mean and standard deviation were used to assess airway clearance scores in the study and control groups.

Inferential Statistics

- Independent t-test was used to compare the pre-test and post-test airway clearance scores between the study and control groups.

- Paired t-test was used to compare the pre-test and post-test airway clearance scores within the study group.

- Chi-square test was used to determine the association between airway clearance levels and selected demographic and clinical variables such as age, gender, diagnosis, duration of mechanical ventilation, type of airway, and suction frequency.

Demographic Variable	Study Group		Control Group	
	Frequency (N)	Percentage (%)	Frequency (N)	Percentage (%)
<b>Gender</b>				
Male	7	46.7	9	60%
Female	8	53.3%	6	40%
<b>Age</b>				
20 -29	4	26.7%	6	40%
30-39	5	33.3%	4	26.7%
40-49	4	26.7%	3	20%
>50	2	13.3%	2	13.3%
<b>Diagnosis</b>				
Pneumonia	5	33.3%	6	40%
COPD	4	26.7%	3	20%
Trauma	3	20%	3	20%
Neurological	3	20%	3	20%
<b>Mechanical ventilation</b>				
5 - 7days	5	33.3%	6	40%
8 - 14days	6	40%	5	33.3%
>14 days	4	26.7%	4	26.7%
<b>Type of airway</b>				
Tracheostomy	6	40%	5	33.3 %
Endotracheal tube	9	60%	10	66.6%
<b>Suction Frequency per shift</b>				
1 - 2 times	6	40%	7	46.7%
2 - 3 times	5	33.3%	4	33.3%
>4 times	4	26.7%	4	26.7%

Table 4.1 Frequency and percentage distribution of demographic variables of subjects.

V. RESULT

The demographic findings showed that the majority of patients in the study group were female (53.3%), while the majority in the control group were male (60%). Most participants belonged to the age group of 20–39 years. Pneumonia was the most common diagnosis in both groups, and most patients had endotracheal tubes. Pre-test findings revealed that most patients in both groups had moderate airway clearance, with no significant difference between the study and control groups before the intervention. After implementation of the nurse-led suctioning protocol, 93.3% of patients in the study group achieved effective airway clearance, whereas only 13.3% of patients in the control group showed effective airway clearance. The mean airway clearance score in the study group increased significantly from  $35.4 \pm 8.2$  during pre-test to  $82.4 \pm 5.5$  during post-test ( $p < 0.001$ ). A significant association was found between post-test airway clearance and variables such as diagnosis and duration of mechanical ventilation. No significant association was found with age, gender, type of airway, and suction frequency. The findings concluded that the nurse-led suctioning protocol was effective in improving airway clearance among intubated patients admitted in the ICU of NMCH, Jamuhar.

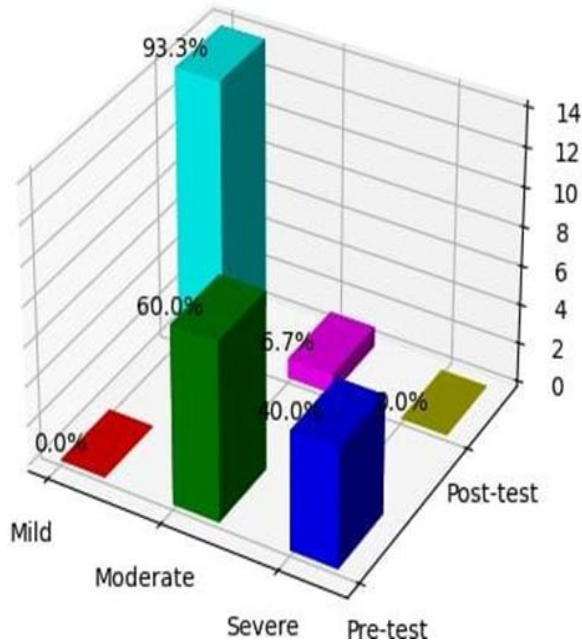


Figure 4.9 Comparison of pre-test and post-test level of airway clearance score in ICU in study group.

VI. SUMMARY OF DATA ANALYSIS

The study was conducted among 30 intubated patients admitted in the ICU of NMCH, Jamuhar, with 15 patients each in the study and control groups. The collected data were analysed using descriptive and inferential statistics.

The pre-test findings showed no significant difference in airway clearance between the study and control groups. After implementation of the nurse-led suctioning protocol, the study group showed significant improvement in airway clearance compared to the control group.

The mean airway clearance score in the study group increased significantly from pre-test to post-test, indicating the effectiveness of the intervention. Significant association was found between airway clearance and selected clinical variables such as diagnosis and duration of mechanical ventilation.

VII. DISCUSSION

The present study was conducted to evaluate the effectiveness of a nurse-led suctioning protocol on airway clearance among intubated patients admitted in the ICU of NMCH, Jamuhar. The findings showed that the protocol was effective in improving airway clearance among mechanically ventilated patients.

The pre-test findings revealed that most patients in both the study and control groups had moderate airway clearance, showing similarity between the groups before intervention. After implementation of the protocol, the study group showed marked improvement in airway clearance compared to the control group.

The mean airway clearance score increased significantly in the study group from pre-test to post-test, indicating the effectiveness of the nurse-led suctioning protocol. These findings are supported by previous studies which reported that evidence-based suctioning practices improve secretion clearance and oxygenation while reducing complications.

A significant association was found between airway clearance and variables such as diagnosis and duration of mechanical ventilation, whereas other demographic variables showed no significant association.

The study concluded that the nurse-led suctioning protocol was effective in improving airway clearance

among intubated patients and can be incorporated into routine ICU nursing practice.

### VIII. CONCLUSION

The study concluded that the nurse-led suctioning protocol was effective in improving airway clearance among intubated patients admitted in the ICU of NMCH, Jamuhar. The protocol significantly improved secretion clearance and airway patency among mechanically ventilated patients. Evidence-based suctioning practices helped in maintaining oxygenation and reducing airway complications. Therefore, the nurse-led suctioning protocol can be incorporated into routine ICU nursing care to improve patient outcomes and quality of care. Limitations

The study was limited to a small sample size of 30 intubated patients.

The study was conducted only in the ICU of NMCH, Jamuhar; therefore, generalization of findings may be limited.

The study assessed only short-term airway clearance outcomes after implementation of the nurse-led suctioning protocol.

Long-term outcomes such as duration of ICU stay, ventilator-associated pneumonia, and mortality were not evaluated.

Variations in patients' clinical conditions and diagnoses could have influenced airway clearance outcomes.

### IX. NURSING IMPLICATION

The findings of the study have important implications for nursing practice, nursing education, nursing administration, and nursing research.

#### Nursing Practice

Nurses working in ICUs should follow standardized evidence-based suctioning protocols to improve airway clearance and reduce complications among intubated patients.

#### Nursing Education

The study highlights the need for regular training and educational programs regarding proper endotracheal suctioning techniques for nursing students and staff nurses.

#### Nursing Administration

Nursing administrators should develop and implement standard suctioning protocols in ICUs and ensure adequate supervision and monitoring of suctioning practices.

#### Nursing Research

Further studies can be conducted with larger sample sizes and in different clinical settings to strengthen evidence regarding nurse-led suctioning protocols.

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