

“EFFECTIVENESS OF FOLEY'S CATHETER SUCTIONING ON MUCOSAL INJURY AND PAIN AMONG PATIENTS WITH TRACHEOSTOMY TUBES IN A TERTIARY CARE HOSPITAL, BELAGAVI: A QUASI-EXPERIMENTAL STUDY”

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ABSTRACT

Background: Tracheostomy patients frequently require suctioning for airway clearance. Conventional suctioning techniques may cause mucosal injury, pain, bleeding, and discomfort. Foley's catheter suctioning is considered a safer alternative because of its smooth rounded tip, which may reduce trauma during suctioning.

Aim: To evaluate the effectiveness of Foley's catheter suctioning on mucosal injury and pain among patients with tracheostomy tubes.

Materials and Methods: A quantitative evaluative research approach with a quasi-experimental pre-test post-test control group design was adopted. Fifty-four patients with tracheostomy tubes were selected through purposive sampling and allocated into experimental (n=27) and control (n=27) groups. Mucosal injury was assessed using the Modified Tracheostomy Mucosal Injury Assessment Scale (TMIAS) and pain was assessed using the Numerical Pain Rating Scale (NPRS). The experimental group received Foley's catheter suctioning whereas the control group received conventional suctioning. Data were analyzed using descriptive and inferential statistics including Mann-Whitney U test and Wilcoxon Signed Rank test.

Results: Pre-test findings revealed no statistically significant difference between the groups for mucosal injury (U=334.500, p=0.595) and pain (U=340.000, p=0.650). Post-test results showed significant improvement in the experimental group. The median TMIAS score reduced from 3.00 to 2.00 (Z=-4.362, p<0.05), whereas pain scores reduced from 6.00 to 4.00 (Z=-4.512, p<0.05). Significant post-test differences were observed between groups for mucosal injury (U=159.500, p<0.05) and pain (U=110.000, p<0.05).

Conclusion: Foley's catheter suctioning was effective in reducing mucosal injury and pain among patients with tracheostomy tubes. The technique is simple, safe, cost-effective, and can be incorporated into routine nursing practice.

Keywords: Foley's catheter suctioning, tracheostomy, mucosal injury, pain, airway suctioning, nursing intervention.

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INTRODUCTION

Tracheostomy is a surgically created opening in the anterior wall of the trachea to establish a direct airway for patients requiring prolonged ventilatory support, airway protection, or management of upper airway obstruction. It is a commonly performed procedure in intensive care

units and critical care settings. Although tracheostomy provides several clinical benefits, patients often require frequent suctioning to maintain airway patency and remove accumulated secretions. Effective suctioning is therefore an essential component of tracheostomy care and plays a vital role in preventing airway obstruction

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and respiratory complications.^{1,2}

Endotracheal and tracheostomy suctioning are routinely performed nursing procedures; however, they are associated with several adverse effects including hypoxemia, bleeding, mucosal trauma, infection, pain, anxiety, and hemodynamic instability. Repeated insertion of suction catheters can cause mechanical irritation of the tracheal mucosa, resulting in inflammation, edema, ulceration, and tissue injury. Such complications may delay healing, increase patient discomfort, and contribute to additional

morbidity.^{3,4}

Mucosal injury is one of the most frequently encountered complications of repeated suctioning procedures. Trauma to the tracheal mucosa may occur due to excessive negative pressure, deep catheter insertion, repeated suction passes, or the use of rigid suction catheters. The resulting tissue damage may manifest as erythema, edema, bleeding, ulceration, and increased susceptibility to infection. Several studies have highlighted the importance of minimizing suction-related trauma through the adoption of safer suctioning techniques and evidence-based clinical practices.^{5,6}

Pain during suctioning is another major concern among patients with tracheostomy tubes. Suctioning stimulates sensitive airway structures and may provoke discomfort, coughing, anxiety, and physiological stress responses. Patients frequently report suctioning as one of the most distressing procedures experienced during hospitalization. Effective interventions aimed at reducing pain and discomfort during suctioning can significantly improve patient experience and overall quality of care.^{7,8}

Foley's catheter suctioning has emerged as a potentially safer alternative to conventional suction catheters. The Foley's catheter possesses a soft, flexible structure and a rounded atraumatic tip that may reduce friction and direct trauma to the tracheal mucosa during insertion. By minimizing contact injury to airway tissues, Foley's catheter suctioning may contribute to reduced mucosal damage, lower pain perception, and improved patient comfort.⁹

Previous investigations have demonstrated that modifications in suctioning techniques can significantly influence patient outcomes. Research conducted among tracheostomy patients has reported lower rates of mucosal injury and improved tolerance when less traumatic suctioning methods are utilized. Evidence also suggests that gentle suctioning techniques can reduce complications such as bleeding, airway irritation, and procedural discomfort.^{10,11}

Despite the growing emphasis on evidence-based airway management, limited studies have

evaluated the effectiveness of Foley's catheter suctioning among patients with tracheostomy tubes, particularly within the Indian healthcare setting. Most existing literature focuses on conventional suctioning methods, and there remains a need for further research to establish safer alternatives that can be incorporated into routine nursing practice.¹²

Nurses play a pivotal role in airway management and tracheostomy care. Identifying suctioning techniques that reduce mucosal trauma and pain can enhance patient safety, promote comfort, and

improve clinical outcomes. Therefore, the present study was undertaken to evaluate the effectiveness of Foley's catheter suctioning on mucosal injury and pain among patients with tracheostomy tubes admitted to a tertiary care hospital in Belagavi.

MATERIALS AND METHODS

Research Approach

A quantitative evaluative research approach was adopted for the present study.

Research Design

A quasi-experimental pre-test–post-test control group design was used to assess the effectiveness of Foley's catheter suctioning on mucosal injury and pain among patients with tracheostomy tubes.

Setting

The study was conducted in the Intensive Care Units (ICUs) of KLE Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi, Karnataka.

Participants

The study population comprised patients with tracheostomy tubes admitted to the Intensive Care Units.

- **Sample size:** 54 participants
- **Sampling technique:** Non-probability purposive sampling
- **Group allocation:** Experimental group (n = 27) and Control group (n = 27)

Inclusion Criteria

- Patients aged between 20 and 60 years.
- Patients with tracheostomy tubes requiring suctioning.
- Patients having very mild or mild mucosal injury (TMIAS score 0–5) at baseline assessment.
- Patients who were conscious and able to communicate pain levels.
- Both male and females patients.

Exclusion Criteria

- Patients with moderate or severe mucosal injury.
- Patients with active bleeding from the tracheostomy site.

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- Patients with severe respiratory instability requiring emergency interventions.
- Patients with facial or airway abnormalities interfering with suctioning.
- Patients whose representatives refused consent.

Sample Size Determination

The sample size was calculated based on findings from previous literature and pilot study observations. Considering a significance level of 5% and adequate statistical power, a minimum sample size of 27 participants per group was

required. Therefore, a total of 54 participants were included in the study.

Measurement Tools

Data were collected using the following instruments:

1. Socio-demographic and Clinical Data Questionnaire

The questionnaire included:

- Age
- Gender
- Frequency of suctioning per day
- Type of tracheostomy tube used

2. Modified Tracheostomy Mucosal Injury Assessment Scale (TMIAS)

The TMIAS was used to assess the degree of tracheal mucosal injury and classify it as:

- Very Mild
- Mild
- Moderate
- Severe

3. Numerical Pain Rating Scale (NPRS)

Pain intensity was assessed using the Numerical Pain Rating Scale ranging from 0 to 10:

- Mild Pain
- Moderate Pain
- Severe Pain

Intervention

Experimental Group

Participants in the experimental group received suctioning using a Foley's catheter as per the study protocol in addition to routine nursing care.

Control Group

Participants in the control group received conventional tracheostomy suctioning according to hospital protocol.

Duration of Intervention

- Intervention was administered during tracheostomy suctioning procedures.
- Pre-test assessment was conducted before intervention.
- Post-test assessment was conducted after implementation of the suctioning procedure as per protocol.

Data Collection Procedure

Step 1

Administrative permission was obtained from the concerned hospital authorities and ethical clearance was secured from the Institutional Ethics Committee.

Step 2

The purpose and procedure of the study were explained to patients and their legally authorized representatives. Participants fulfilling the inclusion criteria were selected.

Step 3

Written informed consent was obtained from the legally authorized representatives.

Step 4

Baseline data were collected using the socio-demographic questionnaire. Pre-test assessment of mucosal injury was performed using the Modified Tracheostomy Mucosal Injury Assessment Scale (TMIAS), and pain was assessed using the Numerical Pain Rating Scale (NPRS).

Step 5

The experimental group received Foley's catheter suctioning, whereas the control group received conventional suctioning.

Step 6

Post-test assessment of mucosal injury and pain was carried out using the same instruments.

Step 7

The collected data were organized, tabulated, and prepared for statistical analysis.

Data Analysis

Data were analyzed using descriptive and inferential statistics.

Descriptive Statistics

- Frequency
- Percentage
- Median
- Interquartile Range (IQR)

Inferential Statistics

- Mann-Whitney U Test
- Wilcoxon Signed Rank Test
- Chi-square Test

The statistical tests were used as follows:

- **Mann-Whitney U Test:** To compare mucosal injury and pain scores between the experimental and control groups.
- **Wilcoxon Signed Rank Test:** To compare pre-test and post-test scores within each group.
- **Chi-square Test:** To determine the association between mucosal injury, pain levels, and selected socio-demographic variables.

A p-value of **less than 0.05** was considered statistically significant.

Ethical Considerations

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- Ethical approval was obtained from the Institutional Ethics Committee of KAHER Institute of Nursing Sciences, Belagavi.
 - Administrative permission was obtained from KLE Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi.
 - Written informed consent was obtained from legally authorized representatives of participants.
 - Confidentiality and anonymity of participants were maintained throughout the study.
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- Participants were assured that the information collected would be used solely for research purposes.

RESULTS:

Socio-Demographic Findings

- Majority of participants in both groups were aged 41–60 years, with 44.4% in the control group and 29.6% in the experimental group belonging to the 51–60 years age category.
- Females constituted the majority in the control group (66.7%), whereas males and females were almost equally distributed in the experimental group.
- Most participants required suctioning more than five times per day (55.6% in the control group and 70.4% in the experimental group).
- Nearly all participants in both groups used plastic tracheostomy tubes (96.3%).
- The baseline characteristics of participants were comparable in both groups.

Baseline Findings

- At pre-test, 70.4% of participants in both groups had mild mucosal injury, while 29.6% had very mild mucosal injury according to the TMIAS scale.
- No participants in either group had moderate or severe mucosal injury during the pre-test.
- Most participants reported moderate to severe pain before the intervention.
- There was no statistically significant difference between the experimental and control groups at baseline with respect to mucosal injury ($U=334.500$, $p=0.595$) and pain score ($U=340.000$, $p=0.650$), indicating group comparability.

Post-Intervention Findings

- Following Foley's catheter suctioning, 96.3% of participants in the experimental group had very mild mucosal injury, compared to only 33.3% in the control group.
- Mild mucosal injury decreased substantially in the experimental group, with only 3.7% remaining in the mild category.

- Post-test pain assessment revealed a marked reduction in pain among participants in the experimental group.

- Only 3.7% of participants in the experimental group reported severe pain after the intervention, compared to 40.7% in the control group.

Effectiveness of Intervention

- Foley's catheter suctioning demonstrated significant effectiveness in reducing mucosal injury among patients with tracheostomy.
- A statistically significant difference was observed between the experimental and control groups in post-test TMIAS scores ($U=159.500$, $Z=-3.661$, $p<0.05$).
- The intervention also significantly reduced pain levels among participants in the experimental

group ($U=110.000$, $Z=-4.491$, $p<0.05$).

- Within-group comparison showed significant improvement in both mucosal injury and pain scores among participants who received Foley's catheter suctioning.

Association Findings

- No statistically significant association was found between mucosal injury and selected demographic variables such as age, gender, frequency of suctioning, and type of tracheostomy tube in either group ($p>0.05$).
- No statistically significant association was observed between pain levels and selected demographic variables in either group ($p>0.05$).
- The findings indicate that the improvement in mucosal injury and pain was primarily related to the intervention rather than demographic characteristics.

DISCUSSION

The present study demonstrated that Foley's catheter suctioning significantly reduced mucosal injury and pain among patients with tracheostomy. The findings support the effectiveness of Foley's catheter suctioning as a safer and less traumatic alternative to conventional suctioning techniques.

The assessment of mucosal injury revealed comparable baseline scores in both groups before the intervention. Following the intervention, the experimental group showed a substantial reduction in mucosal injury, with the majority of participants shifting from mild injury to very mild injury. In contrast, the control group exhibited only minimal improvement. These findings suggest that Foley's catheter suctioning minimizes trauma to the tracheal mucosa during suctioning procedures.

The study also demonstrated a significant reduction in pain among participants who received Foley's catheter suctioning. Most participants initially reported moderate to severe pain during suctioning. However, after the intervention, pain levels decreased considerably,

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and only a small proportion of participants continued to experience severe pain. This improvement may be attributed to the softer and less traumatic nature of Foley's catheter suctioning compared to conventional suctioning methods.

The findings are consistent with previous studies that reported reduced mucosal trauma, bleeding, and discomfort with modified suctioning type of tracheostomy tube. These findings indicate that the effectiveness of the intervention was independent of participant characteristics.

Incorporating Foley's catheter suctioning into routine tracheostomy care may enhance patient comfort, reduce procedure-related complications, and improve the overall quality of nursing care.

CONCLUSION

The study concluded that Foley's catheter suctioning is effective in reducing mucosal injury and pain among patients with tracheostomy. The intervention significantly improved post-test mucosal injury and pain scores when compared with conventional suctioning methods.

Foley's catheter suctioning is a simple, safe, economical, and minimally invasive technique that can reduce tracheal mucosal trauma and improve patient comfort during suctioning

TABLES AND GRAPHS:

Table 1 Distribution of participants in experimental and control group

Variables	Categories	Control Group (n=27)		Experimental Group (n=27)	
		n	%	n	%
Age (years)	20–30	3	11.1	3	11.1
	31–40	3	11.1	5	18.5
	41–50	9	33.3	11	40.7
	51–60	12	44.4	8	29.6
Gender	Male	9	33.3	13	48.1
	Female	18	66.7	14	51.9
Frequency of suctioning/day	1–5	12	44.4	8	29.6
	>5	15	55.6	19	70.4

techniques. The reduction in mucosal injury and pain observed in the present study supports the use of Foley's catheter suctioning as an effective nursing intervention for tracheostomy care.

No significant association was found between mucosal injury or pain and demographic variables such as age, gender, frequency of suctioning, or

procedures. Therefore, it can be recommended as an effective nursing intervention in tracheostomy care to minimize complications and enhance patient outcomes.

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Type of tracheostomy tube used	Plastic	26	96.3	26	96.3
	Metal	1	3.7	1	3.7

Table 2 Distribution of participants by TMIAS (Pre-post test)

Variables	Categories	Control Group (n=27)		Experimental Group (n=27)	
		n	%	n	%
TMIAS (Pre-test)	Very Mild	8	29.6	8	29.6
	Mild	19	70.4	19	70.4
	Moderate	0	0.0	0	0.0
	Severe	0	0.0	0	0.0
TMIAS (Post-test)	Very Mild	9	33.3	26	96.3
	Mild	18	66.7	1	3.7
	Moderate	0	0.0	0	0.0
	Severe	0	0.0	0	0.0

Table 3 Distribution of participants by Pain Scale (Pre-post test)

Variables	Categories	Control Group (n=27)		Experimental Group (n=27)	
		n	%	n	%
Pain Scale (Pre-test)	Mild	1	3.7	0	0.0
	Moderate	13	48.1	16	59.3
	Severe	13	48.1	11	40.7

Table 4 Between and within group comparison of TMIAS

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Pain Scale (Post- test)	Mild	2	7.4	7	25.9
	Moderate	14	51.9	19	70.4
	Severe	11	40.7	1	3.7

TMIAS	Control Group		Experimental Group		U	Z	Significance
	Median	IQR	Median	IQR			
Pre-test	4.00	2.00	3.00	2.00	334.500	-0.532	0.595
Post-test	4.00	2.00	2.00	1.00	159.500	-3.661	<0.05*
Z	-2.236		-4.362				
Significance	0.025*		<0.05*				

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