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Endotracheal Suctioning and Oxygen Saturation in an Intensive Care Patient with Ischemic Stroke and Decreased Consciousness: A Descriptive Case Study

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Abstract

Background: Patients with ischemic stroke and decreased consciousness are at high risk of ineffective airway clearance due to impaired cough reflex and accumulation of airway secretions. This condition may lead to hypoxemia and further neurological deterioration, requiring appropriate airway management in intensive care settings.

Objective: To describe the implementation of endotracheal suctioning as part of nursing care in an intensive care patient with ischemic stroke and decreased consciousness, with particular attention to oxygen saturation and clinical airway status.

Methods: A descriptive single-patient case study was conducted in the general intensive care unit. Data were collected through direct observation, physical examination, bedside monitoring, and medical record review. The nursing care process included assessment, diagnosis, planning, implementation, and evaluation. Endotracheal suctioning was performed according to clinical indications and unit protocol, and oxygen saturation was observed before and after suctioning over a five-day period.

Results: At baseline, the patient presented with decreased consciousness, retained airway secretions, bilateral rhonchi, weak cough reflex, tachypnea, and oxygen saturation of 92%. Across the five-day observation period, suctioning was followed by short-term improvement in oxygen saturation, with post-procedure values reaching 97–98%, accompanied by reduced secretion burden and clearer breath sounds. By the end of observation, respiratory status was more stable and suctioning was required less frequently.

Conclusion: In this case, endotracheal suctioning performed on the basis of clinical indications was associated with improvement in short-term oxygen saturation and airway clearance indicators. These observations should be interpreted within the broader context of comprehensive intensive care and should not be taken as evidence of independent treatment effect. Further studies with stronger designs are needed to evaluate the contribution of suctioning in neurocritical patients.

Keywords: Airway clearance; endotracheal suctioning; intensive care nursing; oxygen saturation; ischemic stroke.

INTRODUCTION

Stroke remains one of the leading causes of mortality and long-term disability worldwide,

accounting for approximately 13–15% of total global deaths. Each year, an estimated 15 million people experience stroke globally, with around 5

million deaths and another 5 million individuals left with permanent disabilities (1). These figures highlight the substantial burden of stroke, not only in terms of mortality but also in long-term functional impairment and socioeconomic impact. This burden is particularly significant in developing countries, where access to rehabilitation and long-term care may be limited.

Ischemic stroke accounts for approximately 80% of all stroke cases and occurs due to obstruction of cerebral blood flow, leading to ischemia and brain tissue damage. The underlying pathophysiological processes involve disruption of neuronal function and synaptic transmission, which can impair neurological regulation of vital functions, including respiration (2,3). From a broader perspective, stroke involves complex mechanisms related to vascular occlusion, inflammation, and neuronal injury, which contribute to clinical deterioration (4,6).

In Indonesia, stroke continues to represent a major public health concern. Data from the 2018 Basic Health Research (Riset Kesehatan Dasar) reported a prevalence of approximately 10.9–11.0 per thousand population, with relatively similar distribution between men and women (Ministry of Health Republic of Indonesia, 2018). The high incidence of stroke contributes to increased healthcare utilization, prolonged hospitalization, and long-term dependency, placing considerable strain on healthcare systems and families. In West Java Province, the prevalence reaches 11.4 per thousand, further emphasizing the regional impact of this condition (6). Ischemic stroke accounts for approximately 80% of all stroke cases, making it the most common subtype. This condition occurs due to the obstruction of cerebral blood flow, leading to ischemia and subsequent brain tissue damage. Patients with ischemic stroke often experience a range of neurological impairments, including decreased level of consciousness, motor deficits, speech disturbances, and sensory dysfunction (1). In critically ill patients, decreased consciousness significantly affects protective airway reflexes such as coughing and swallowing, which are essential for maintaining airway patency.

Previous studies have emphasized that ineffective airway clearance is a common clinical problem in patients with severe neurological impairment. Retained airway secretions have been associated with hypoxemia, increased work of breathing, and a higher risk of complications

such as aspiration pneumonia. Endotracheal suctioning is widely used as a nursing intervention to maintain airway patency and improve oxygenation in critically ill patients. Evidence suggests that appropriate suction techniques, including controlled negative pressure, limited duration, and pre-oxygenation, are associated with improved oxygen saturation and reduced secretion accumulation (7,8).

The impairment of these protective reflexes increases the risk of secretion retention within the respiratory tract, leading to ineffective airway clearance. This condition is commonly observed in patients admitted to intensive care units and is associated with decreased oxygenation, increased work of breathing, and a higher risk of complications such as aspiration pneumonia. If not managed appropriately, ineffective airway clearance may contribute to further clinical deterioration and negatively affect patient outcomes. Therefore, effective airway management is a critical component of nursing care in patients with ischemic stroke, particularly those with decreased consciousness. One of the primary interventions used to address this condition is endotracheal suctioning, which aims to remove airway secretions and maintain airway patency. The procedure must be performed using standardized techniques, including appropriate suction pressure, limited duration, sterile precautions, and pre-oxygenation, to ensure patient safety and minimize complications.

This study aims to describe the implementation of endotracheal suctioning as part of the nursing care process in a patient with ischemic stroke and decreased consciousness, with a focus on changes in oxygen saturation and airway clearance. This study provides a detailed case-based clinical description of suction-based airway management in a neurocritical patient. By focusing on the nursing care process and patient responses over time, this study offers practical insights into the application of evidence-based interventions in real clinical settings. It also addresses the limited availability of case-based analyses specifically examining airway clearance management in ischemic stroke patients with decreased consciousness.

METHODS

Study Design

This study employed a descriptive single case study design to explore the implementation of

nursing care in a patient with ischemic stroke experiencing ineffective airway clearance. This approach was chosen to provide an in depth clinical description of the nursing process and patient responses in a real world intensive care setting. The implementation of nursing care in this study followed the structured nursing process framework, which includes assessment, diagnosis, planning, implementation, and evaluation (9,10).

Participant

The participant was one patient diagnosed with ischemic stroke and decreased level of consciousness who was treated in the General Intensive Care Unit (GICU). The inclusion criteria were: (1) confirmed diagnosis of ischemic stroke, (2) decreased level of consciousness (Glasgow Coma Scale ≤ 12), and (3) presence of retained airway secretions requiring airway management. Purposive sampling was used to select a patient who met the clinical criteria relevant to the study objective.

Intervention Protocol and Implementation

The intervention consisted of endotracheal suctioning as part of routine nursing care to manage ineffective airway clearance. The procedure was performed based on standard operating procedures and evidence based airway management guidelines. Key steps included respiratory assessment, identification of secretion retention, preparation of sterile equipment, pre-oxygenation, insertion of the suction catheter, application of negative pressure for 10–15 seconds, and post-procedure evaluation. The intervention was carried out by GICU nurses trained in airway management. Suctioning was performed based on clinical indications during the patient's stay in the GICU. Consistency was maintained through adherence to standardized protocols and continuous monitoring of patient responses.

Data Collection Procedure

Data were collected through direct observation, physical examination, monitoring of oxygen saturation (SpO_2), and review of medical records. Clinical parameters observed included respiratory rate, oxygen saturation, breath sounds, secretion characteristics, cough reflex, and level of consciousness. Data collection was conducted during the patient's GICU stay and documented using structured nursing records.

Data Analysis

Data were analyzed descriptively to evaluate changes in the patient's clinical condition before and after suction interventions. The analysis followed the stages of the nursing process, including assessment, diagnosis, planning, implementation, and evaluation. Clinical indicators such as oxygen saturation, airway secretions, and respiratory status were compared over time to describe the patient's response to nursing care.

Ethical Considerations

This study was conducted with permission from the hospital authority. Informed consent was obtained from the patient's family due to the patient's decreased level of consciousness. Patient confidentiality was maintained by anonymizing all identifying information. The intervention described was part of routine nursing care, and no additional procedures were performed. Ethical principles, including beneficence, non-maleficence, and confidentiality, were upheld throughout the study.

RESULT

The patient was admitted to the intensive care unit with a diagnosis of ischemic stroke and decreased level of consciousness, requiring airway management due to ineffective airway clearance. A five-day observation was conducted focusing on the implementation of endotracheal suctioning and its impact on respiratory status.

On the first day of care, the patient presented with ineffective airway clearance characterized by tachypnea, decreased oxygen saturation (SpO_2 92%), bilateral rhonchi, weak cough reflex, and moderate thick secretions. Suction was performed based on clinical indications, resulting in improved airway patency. Oxygen saturation increased to 97% following suction, and breath sounds became clearer compared to pre-intervention findings.

On the second day, retained secretions were still present, with persistent rhonchi and weak cough reflex. Suction interventions were continued according to clinical indications. Oxygen saturation before suction ranged from 93–95% and improved to 97% after the procedure. Secretion volume remained moderate but showed slight reduction compared to the first day. No complications related to suction were observed.

Table 1. Changes in Respiratory Parameters and Oxygen Saturation Before and After Endotracheal Suctioning Over a Three-Day Observation Period

Parameter	Day 1	Day 2
GCS	E3M4VT	E3M4VT
Respiratory Rate (breaths/ min)	28	26
SpO ₂ Before Suction (%)	92	93-95
SpO ₂ After Suction (%)	97	97
Breath Sounds	Bilateral rhonchi	Bilateral rhonchi (reduced)
Secretion Volume	Moderate, thick	Moderate (decreasing)
Cough Reflex	Weak	Weak

By the third day, respiratory status showed gradual improvement. The amount of airway secretions decreased, and rhonchi were less prominent on auscultation. Suction frequency was reduced based on clinical need. Oxygen saturation increased from 95-96% before suction to 98% after suction. The cough reflex showed slight improvement during airway stimulation.

On the fourth day, airway patency was maintained with minimal secretion accumulation. Suction was performed only when indicated. Breath sounds were improved with minimal rhonchi. Oxygen saturation remained stable at 96% before suction and increased to 98% after the procedure. The cough reflex became more responsive.

On the fifth day, respiratory status demonstrated further stabilization. Airway secretions were minimal, and breath sounds were vesicular without additional sounds. Suction interventions were rarely required due to improved airway clearance. Oxygen saturation remained stable between 96-97% and increased to 98% following suction when performed. The cough reflex was present, although not fully effective.

Overall, the five day observation demonstrated a progressive improvement in airway clearance, reflected by reduced secretion volume, improved breath sounds, and increased oxygen saturation following suction interventions. No complications associated with suction

procedures were documented throughout the observation period.

DISCUSSION

This study described the implementation of endotracheal suctioning as part of nursing care in a patient with ischemic stroke who experienced ineffective airway clearance in the intensive care unit. Over a five day observation period, gradual improvement was observed in respiratory parameters, including respiratory rate, oxygen saturation, secretion volume, and breath sounds. The patient initially presented with decreased level of consciousness, tachypnea, bilateral rhonchi, weak cough reflex, and moderate airway secretions. Following suction interventions, oxygen saturation consistently increased after each procedure, accompanied by progressive stabilization of respiratory status.

These findings are consistent with clinical guidelines from the American Association for Respiratory Care (11-15), which recommend endotracheal suctioning in patients with retained secretions, ineffective cough, and abnormal breath sounds. When performed using appropriate techniques including controlled negative pressure, limited duration, and pre-oxygenation suctioning supports airway patency and oxygenation. In this case, adherence to standardized procedures was associated with improved clinical indicators without observed complications.

Previous studies have reported similar improvements in oxygenation following airway secretion management in critically ill patients (16,17). The increase in oxygen saturation observed after suctioning in this case aligns with these findings, suggesting that secretion removal may enhance ventilation and gas exchange. However, the observed improvements should be interpreted cautiously, as the patient also received comprehensive intensive care management, including oxygen therapy and continuous monitoring. Therefore, the contribution of suction intervention cannot be considered as the sole factor influencing clinical outcomes.

From a neurological perspective, patients with ischemic stroke are highly susceptible to ineffective airway clearance due to impaired cough and swallowing reflexes (18). This condition increases the risk of secretion retention and respiratory complications. In this context, endotracheal suctioning serves as a

supportive nursing intervention aimed at maintaining airway patency. From a physiological perspective, the nervous system plays a critical role in regulating respiratory function, and impairment due to stroke can disrupt airway protective reflexes and breathing patterns (19,20).

The key contribution of this study lies in demonstrating the role of nurses in conducting systematic respiratory assessment and delivering timely, indication-based suction interventions. Rather than routine application, suction was performed based on clinical indicators such as secretion accumulation, abnormal breath sounds, and decreased oxygen saturation. This approach reflects the importance of clinical judgment and adherence to evidence-based protocols in ensuring patient safety and optimizing respiratory outcomes.

This study has several limitations. As a single case study, the findings cannot be generalized to broader populations. The short observation period of three days limits evaluation of long-term outcomes. Additionally, objective measures such as arterial blood gas analysis were not included to further validate changes in oxygenation. Despite these limitations, this case provides a focused clinical description of suction-based airway management in a neurocritical patient. It highlights how structured, protocol-based nursing interventions can support respiratory stability when integrated with comprehensive intensive care. Further research with larger samples and more rigorous designs is needed to better understand the effectiveness of suction interventions in stroke patients.

CONCLUSION

This study described the implementation of suction-based nursing care in managing ineffective airway clearance in a patient with ischemic stroke in the intensive care unit. Over a three-day observation period, improvements were observed in oxygen saturation, respiratory rate, secretion volume, and breath sounds following suction interventions. These findings suggest that structured endotracheal suctioning, when performed based on clinical indications and standardized protocols, may support airway patency and improve oxygenation in neurologically impaired patients.

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Author Contributions

LL: Responsible for study conceptualization, research design, methodology development, data collection, supervision of intervention, data analysis, interpretation of findings, and manuscript preparation.

LOM: Provided methodological input and guidance in data analysis.

LI: Contributed to critical review and revision of the manuscript, as well as final approval of the submitted version.

BR: Contributed to critical review and revision of the manuscript, and approved the final version.

Conflict of Interest

The authors confirm that there are no conflicts of interest related to this study or its publication.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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