



The Effect of Suctioning to Oxygen Saturation Improvement towards ICU Patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang

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Abstract

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Background : Treated ICU patients may experience consciousness deterioration which leads to loss of cough response and increase of saliva and secretions production which blocks the airway. Therefore, patients need to receive suctioning or mucus suctioning to clear the airway. The success of such procedure can be supervised by measuring the patient's oxygen saturation level before and after the procedure. The objection of this research was to analyze the effect of suctioning to oxygen saturation improvement towards ICU patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang.

Methods : The research was conducted from November to December 2022 in a quantitative form with a pre-experimental layout and one-group pre-posttest design. It involved 30 respondents with accidental sampling technique. The instruments used were suction observation sheets and the oximeter. The gained data were then analyzed using SPSS with the Mc Nemar test.

Results : The results showed that the average value of the patient's oxygen saturation pre-suctioning was 93.73% whilst post-suctioning was 96.23%. The statistical test results show the value of $p = 0.002$, which means that there is an effect of suctioning to oxygen saturation improvement towards ICU patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang.

Conclusion : Suctioning has an effect to improve the oxygen saturation towards ICU patients in Prof. Dr. W. Z. Johannes Hospital Regional Public Hospital Kupang.

Keywords : intensive care unit, oxygen saturation, suction

INTRODUCTION

Intensive Care Unit (ICU) admitted patients are those who experience a critical condition accompanied by a deterioration in consciousness that threatens life.^{1,2} In this state, a patient will lose the response to cough, accompanied by increased saliva and secretions production that block the airway. The fulfillment of the patient's oxygen needs is inadequate.^{3,4} The obstruction in the patient's airway will hinder the entry of oxygen into the patient's body so that oxygen perfusion to the periphery is also reduced, which can be seen from a decline in oxygen saturation.⁵⁻⁷ To overcome this condition, one of the actions that can be taken by a nurse is the precise suctioning to clear the obstruction from the patient's airway. The success of this procedure can be monitored from the change in the patient's oxygen saturation level using a pulse oximeter measurement.⁸ Pulse oximeter detects arterial blood oxygen saturation and its accuracy. Therefore, pulse oximeter readings are very important. Incorrect measurements can lead to patients falling into a situation of undetected hypoxemia or unnecessary use of oxygen therapy, waste of oxygen and inappropriate clinical decision-making.⁹⁻¹¹

The obtained data from the ICU room in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang showed that from January to May 2022 there were 187 ICU admitted adult and pediatric. It also showed that from these 187 patients, there were 57 patients, consisted of 46 adult patients and 11 pediatric patients who had consciousness deterioration, ventilator-supported and needed constant observation. Based on treatment standards in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang, consciousness deteriorated patients with increased accumulation of secretions in the airway are necessary to be treated with suctioning one to two times in every 8 hours or adjusted to the patient's needs if the accumulation of secretions is too much in the patient's airway. The nurse will adjust the pressure on the suction machine, use the right suction catheter, conduct suctioning no longer than 10 and end the procedure by evaluating vital signs which includes observing the patient's oxygen saturation before and after the suctioning procedure.^{12,13} Based on the description above, the purpose of this study is to analyze the effect of suctioning to oxygen saturation improvement towards ICU patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang.

RESEARCH METHODS

This is quantitative research with a pre-experimental research layout. This research design is one group pre and post-test design. The population in this study were all ICU admitted patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang from November to

December 2022 with the inclusion criteria for the adult patients aged more than 20 years, consciousness-deteriorated patients whom attached to an oropharyngeal airway tube (OPA) or endotracheal tube (ETT) with a Glasgow Coma Scale (GCS) value less than 5, patients who are unable to cough and have oxygen saturation (SpO₂) ≤95%. The exclusion criteria determined by researchers for research sampling are pediatric patients who experience consciousness deterioration and patients who are not admitted on the schedule of researchers carrying out tasks in the ICU room. The sampling technique in this study was accidental sampling technique. This sampling technique were chosen because researchers could not predict patients who were admitted to the research location, so patients who were encountered and in accordance with the inclusion criteria that researcher determine will be taken as research sample. Therefore, the number of samples in this study was 30 patients who were treated within a span of two months, from November 2nd to December 30th, 2022. The instruments that were utilized in this research were suction observation sheets and pulse oximeter.

This research was conducted from November 2nd to December 30th, 2022, which was preceded by an ethical clearance from the ethics commission of the Polytechnic of the Ministry of Health Kupang with Number: No.LB.02.03/1/0185/2022. Research data collection was carried out after the researchers explained the aims and objectives of the study and asked for approval from patients' family through informed consent. Researchers observed oxygen saturation before suctioning, then measured the patient's oxygen saturation again shortly after suctioning. However, to see the consistency of changes in oxygen saturation, the researcher monitored patients' condition for two consecutive days of treatment. The first measurement has been done on the first day and the second measurement on the second day of the patient treatment in the ICU room. The results of measuring oxygen saturation before and after suctioning on the second day were taken as research data to continue at the stage of analyzing the effect using statistical tests. The research data were analyzed used SPSS with the Mc Nemar test.

RESULTS

Table 1 shows patients characteristics based on age, gender, additional breathing sounds, breathing equipment and medical diagnosis.

Patients' oxygen saturation before and after suctioning on the 1st observation day in the ICU room at Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang shows in Table 2.

Patients' oxygen saturation before and after suctioning on the 2nd observation day in the ICU room at

TABLE 1
Patients characteristics based on age, gender, additional breathing sounds, breathing equipment and medical diagnosis

Variables		Frequency (n)	Percentage (%)
Age	26-35 years	6	20.0
	36-45 years	8	26.7
	46-55 years	12	40.0
	56-65 years	4	13.3
Gender	Male	18	60.0
	Female	12	40.0
Additional Breath Sounds	Ronchi	25	83.3
	Stridor	4	13.3
	Crackles	1	3.3
Breathing Apparatus	ETT + OPA	21	70.0
	OPA	9	30.0
Medical Diagnosis	Post Craniotomy Surgery	15	50.0
	Stroke	8	26.7
	Sepsis and Metabolic disorders	5	16.7
	PEB and Lung Oedema	2	6.7

TABLE 2
Patients' Oxygen Saturation before and after suctioning on the 1st observation day in the ICU room at Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang

Oxygen Saturation [SpO ₂]	Before Suctioning		After Suctioning	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Less than normal (<95%)	19	63.3	7	23.3
Normal (≥95%)	11	36.7	23	76.7
Oxygen saturation average	92.03%		94.70%	

Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang shows in [Table 3](#).

The effect of suctioning to oxygen saturation improvement towards ICU patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang shows in [Table 4](#).

DISCUSSION

Oxygen saturation (SpO₂) of patients before suctioning in the ICU room at Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang

The average measurement result of patient oxygen saturation before suctioning on the first day was 92.03%.

On the second day of measurement, the average patient oxygen saturation was 93.73% with details of 17 respondents (56.7%) who had SpO₂ less than normal, while 13 respondents (43.3%) had normal SpO₂. The results of this study are also supported by previous research conducted in the ICU room of RSUD R.A.A. Soewondo Pati on 16 research samples which showed that the average oxygen saturation of patients before receiving suctioning was 93.38% or less than normal.¹⁴

Oxygen saturation is a value of the amount of oxygen bound to hemoglobin or the percentage of hemoglobin to oxygen in arterial blood vessels. A decline in the value of oxygen saturation can mean a disturbance in the respiratory system such as hypoxia and airway obstruction. The impact of a decline in oxygen saturation

TABLE 3
Patients' Oxygen saturation before and after suctioning on the 2nd observation day in the ICU room at Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang

Oxygen Saturation [SpO ₂]	Before Suctioning		After Suctioning	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Less than normal (<95%)	17	56.7	7	23.3
Normal (≥95%)	13	43.3	23	76.7
Oxygen saturation average	93.73%		96.23%	

TABLE 4
The effect of suctioning to oxygen saturation improvement towards ICU patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang

Oxygen Saturation [SpO ₂] Before Suctioning	Oxygen Saturation [SpO ₂] After Suctioning				N	Percentage (%)	p value
	Less than normal		Normal				
	(<95%)	(%)	(<95%)	(%)			
Less than normal (<95%)	7	23.3	10	33.3	17	56.7	0.002
Normal (≥95%)	0	0	13	43.3	13	43.3	
Total	7	23.3	23	76.6	30	100	

that occurs for more than 4 minutes and unmaximized supply of oxygen to the brain results irreversible brain damage and patient's death.¹⁵ The normal value of oxygen saturation is ≥95–100%.² Oxygen saturation can be assessed as a component of arterial blood gas/ABGs (SaO₂) or can be measured noninvasively using a pulse oximeter (SpO₂).² One of the objectives of monitoring oxygen saturation before suctioning is to obtain data on the patient's vital sign, which is also part of the oxygen assessment. Another purpose of measuring oxygen saturation is to perform early detection of critical patient conditions that can change rapidly at any time, as well as to evaluate the patient's response to oxygenation activities such as suctioning, repositioning or changes in oxygen concentration (O₂) received by the patient.²

Oxygen saturation of ICU admitted patients is mostly in the less than normal category (<95%) because above-mentioned are critical and chronic patients who generally experience consciousness deterioration. The patient's unconscious condition makes the patient lose the ability to cough effectively accompanied by increased saliva production. This makes the patient's airway obstructed by secretions both in the mouth, bronchus, trachea and lungs. Increased secretion production and consciousness deterioration make the patient unable to remove secretions so that airway obstruction occurs which worsens the patient's condition and oxygen supply to the periphery.² This is in accordance with the results of

this study, namely there were 15 patients (50%) who experienced postoperative craniotomy, which made them experienced consciousness deterioration, lost the ability to maintain an effective airway independently which certainly affected the fulfillment of patient oxygen saturation.

Oxygen saturation of ICU admitted patients need to be monitored because they are critical patients.² A patient's oxygen saturation value indicates the adequacy of oxygenation or perfusion of the patient's tissues and if a decline in oxygen saturation is found, it can be an indicator of oxygen transport failure. Therefore, measuring oxygen saturation is the easiest way to determine the adequacy of oxygen supply to the patient's body.^{2,15}

The researchers argue that ICU admitted patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang had less than normal oxygen saturation was also caused by the disease at the time, namely some had a disease that aggravates their condition as shown in the characteristics. There were 15 patients (50%) who had postoperative craniotomy. Patients also showed symptoms of excessive accumulation of secretions that obstructed the patient's airway as shown by the research data, namely as many as 25 respondents (83.3%) had rhonchi breath sounds. This is in accordance with the theory that supports the results of this study.

Oxygen Saturation (SpO₂) of Patients After Receiving Suction Action in the ICU room of Prof. Dr. W. Z. Johannes Kupang

The result of measuring the average oxygen saturation of patients after receiving suctioning on the first day was 94.70%. On the second day of measurement, the average oxygen saturation was 96.23% with details of 7 respondents (23.3%) who had SpO₂ less than normal, while 23 other respondents (76.7%) had normal SpO₂. The results of this study are supported by previous research conducted on 40 research sample in the ICU room of An-Nisa Tangerang Hospital which stated that the average oxygen saturation of patients after receiving suction action was in the normal category with an average of 97.25%.²

The patient's oxygen saturation needs to be measured after suction because oxygen saturation is an indicator that the patient's oxygen needs are being met.¹⁶ When a patient receives suctioning, there is a process of suctioning mucus that was blocking the patient's airway. Therefore, the results of measuring oxygen saturation after suctioning are expected to show signs that suctioning has an impact on the patient's airway.² A patient's oxygen saturation that is less than normal may change to normal after suctioning because secretions, saliva build-up or other fluids have been cleared from the patient's airway.¹⁷

However, not all patients showed changes in oxygen saturation to normal after suctioning. This is proven by the results of the research which showed that there were still 7 patients (23.3%) who had oxygen saturations less than normal. The researcher believes that these patients' oxygen saturation was also influenced by their clinical condition, namely these patients had a chronic disease that could make the oxygen supply inadequate to the peripheral tissue.

The Effect of Suction Measures on Increasing Oxygen Saturation (SpO₂) Patients in the ICU Room of Prof. Dr. W. Z. Johannes Kupang

The results showed that there was an effect of suctioning on improving patient oxygen saturation due to changes in the average value of oxygen saturation pre- and post-procedure. Before the suctioning was conducted, the results showed that the average oxygen saturation was lower than after the suctioning. This is supported by the results of statistical tests that show a value of $p = 0,002$ ($p < \alpha (0,05)$) which means that there was a significant effect of giving suctioning on improving patient oxygen saturation. Table 4 also shown that before receiving suctioning there were 17 respondents who had SpO₂ less than normal, but after receiving suctioning, 10 respondents (33.3%) had normal SpO₂, and the rest still had SpO₂ less than normal.

The results of this study are supported by research in the ICU room of Ulin Banjarmasin Hospital in 2020 which stated that there were changes in patient oxygen saturation after receiving suctioning. The patient's oxygen saturation increased to normal, and the frequency of suctioning given to patients would provide better results and lead to normal saturation values.¹⁸ The results of other studies have also been carried out in the ICU room of the Bogor City Hospital in 2019 and showed evidence that sufficient suctioning intensity of 4–6 times a day or 1–2 times every 8 hours of care given to 20 patients had maintained the patient's oxygen saturation remained normal, while patients who received suctioning too often or insufficiently would fall into a state of hypoxemia.^{13,19}

Suctioning received by patients who are bedridden and consciousness deteriorated in the ICU is an important procedure to clear the patient's airway from the accumulation of secretions and saliva in the airway.²⁰ An airway that is patent and free of accumulated secretions and saliva will prevent bacterial infection.²¹ Suctioning is a collaborative and invasive procedure that can be performed by nurses for patients who need it. Suctioning is accepted by a number of patients in the ICU because these patients experience clinically critical conditions so that they experience prolonged bed rest with a level of total care needs. In this state, patients cannot fulfill their needs independently, one of which is freeing the airway from accumulated mucus or saliva.²¹

Suctioning that is performed correctly and at the right frequency for the patient will have an impact on oxygen saturation improvement for the patient. However, improper suctioning or not in accordance with standard operating procedures in terms of frequency can have a harmful impact on patients, namely increasing intracanal pressure, infection and even oxygen desaturation.⁸ A decrease in oxygen saturation can occur in patients who receive suctioning too often, because when the mucus suctioning procedure is conducted, it will not only remove fluid or mucus in the patient's airway, but is accompanied by suctioning oxygen from the patient's airway.¹⁹

The researchers argues that suctioning does have an effect on improving patients' oxygen saturation, especially towards unconscious patients. However, suctioning also has a negative impact on patients if the nurse on duty does not perform suctioning according to applicable operational standards.

CONCLUSION

Based on the results of the study, it is concluded that there is an effect of suctioning to oxygen saturation improvement towards ICU patients in Prof. Dr. W. Z. Johannes Regional Public Hospital Kupang.

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