

# Decreased Oxygen Saturation Levels Due to Suction of Endotracheal Tube Mucus

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**Abstract:** The success of treatment in patients with respiratory failure depends not only on early detection, but also on understanding the mechanism of the cause. One of the conditions that can cause respiratory failure is airway obstruction, including obstruction of the Endotracheal Tube (ETT). This type of research uses the Pre Experiment Method using One-Group Pre-test and Post-test Design research design. Determination of the sample is done by accidental sampling, with a total sample of 20 people. Data analysis was performed using the Wilcoxon test with a 95% confidence interval and a value of  $\alpha = 0.05$ . The results obtained from this study indicate that there are differences in oxygen saturation levels before and after mucus suctioning measures are given where there is a difference in the value of oxygen saturation levels of 5.164% and p-value = 0.000 ( $\alpha < 0.05$ ).

## 1 INTRODUCTION

According to WHO (World Health Organization) data the incidence of respiratory failure can result in death and the incidence of data obtained in 2009 the incidence of respiratory failure about 67% of all patients treated in the ICU. And in 2012 respiratory failure began to be prevented by providing care and freeing the airway 58%. The incidence and consequences of acute respiratory failure also depend on the dysfunction of others. A procedure that deserves particular attention, given its direct relationship with the risk of infection, is the endotracheal aspiration (ETA) of intubated patients. A common procedure within intensive care units is the suctioning of respiratory secretions in patients who have been intubated or who have undergone tracheostomy. When patients are unable to mobilize their secretions, they may need suctioning of the secretions from the oropharynx and/or trachea to maintain their airway. Patients may be unable to clear their own airway due to several different problems, including neuromuscular disease, sedation or neurological deficits, such as a CVA. In addition, patients with an artificial airway, such as those who have been intubated, usually require suctioning while they are on a ventilator. Many patients are intubated and mechanically ventilated because of respiratory

distress and respiratory failure. Respiratory failure is an acute or chronic condition with impaired gas exchange and pulmonary functions and is characterized by elevated carbon dioxide or decreased oxygen in the arterial blood. Respiratory failure can result from diverse conditions such as cardiac and respiratory diseases, defects in neuromuscular systems that control breathing, injury to chest, and several lung diseases.

Suctioning may be done through an endotracheal tube, tracheostomy tube, or through the nose or mouth into the trachea. Although each procedure is slightly different, indications, supplies, procedures and risks are similar.

Respiratory failure is one of the causes of increased mortality and morbidity. Every year an estimated 1 million people are treated in ICU due to respiratory failure (Wunssch, 2010). In the United States the incidence of respiratory failure increased from 1,007,549 people in 2001 to 1,917,910 in 2009 (16).

Some cases of respiratory failure end up with mechanical ventilation aimed at assisting or taking an expert respiratory function. Based on data on rank 10 non-communicable diseases (PTM) which cause fatal deaths based on case fatality rate (CFR) in hospital admissions in 2010, the incidence of respiratory failure ranks second at 20, 98%) (7).

Treatment for airway obstruction due to the accumulation of secretions in the Endotracheal Tube (ETT) is to perform mucus suctioning by inserting a suction catheter through the nose / mouth / Endotracheal tube (ETT) which aims to free the airway, reduce sputum retention and prevent sputum suction lung infection. In general, patients who have ETT installed have a poor body response to expel foreign bodies, so suctioning is necessary. (9).

The American –European Consensus On ARDS found an incidence of acute respiratory distress syndrome (ARDS) between 12.6-28.0 cases / 100,000 population / year and deaths from respiratory failure were reported to be around 40%. Under these conditions, the optimal management of respiratory failure patients is very important and we estimate there is a relationship between the basic disease and the results of its management (Bongard, 2014).

The use of mechanical ventilation is a multinational survey of 5000 clients in Europe used in cases of acute respiratory failure (69%), coma (17%), chronic respiratory failure (13%) and neuromuscular use (2%) (Rodriquez, Dojat, and Brocard, 2005). Respiratory assistance should be given adequately according to indications to prevent muscle weakness in breathing because of rest (Smelzer, 2012).

Research conducted by France, (2011) in 12 ICU rooms in Brazil found 843 people (49%) were treated in ICU rooms due to acute respiratory failure and 141 people suffered respiratory failure after being treated in ICU, of the total sufferers of acute respiratory failure 475 people died in the ICU room, and 56 people died after leaving the ICU room.

From the results of studies in Germany and Sweden reported that the incidence of acute respiratory failure in adults 77.6-88.6 cases / 100,000 population / year. Respiratory failure is an indication that the patient is being treated in an intensive care unit (ICU).

One condition that can cause respiratory failure is airway obstruction, including obstruction of the Endotracheal Tube (ETT). Airway obstruction is an abnormal condition due to the inability to cough effectively, can be caused by thick secretions or excess due to infectious diseases, immobilization, static secretions, and ineffective cough due to neurological diseases such as cerebrovascular accident (CVA), effects of sedative treatment, and others (Hidayat, 2013).

Data obtained from the ICU patient registration book Prof. Dr. Dr.R.D. Kandou Manado starting from January-October 2013 the total number of patients treated at the ICU were 411 patients and

those who experienced respiratory failure as many as 132 patients (32.1%). The average patient treated in the ICU is 41-42 patients / month and the average who has experienced respiratory failure is 13-14 patients / month died due to respiratory failure.

Respiratory failure occurs when the exchange of oxygen to carbon dioxide in the lungs is unable to maintain the rate of oxygen consumption (O<sub>2</sub>) and the formation of carbon dioxide (CO<sub>2</sub>) in body cells. This results in arterial oxygen pressure of less than 50 mmHg (hypoxemia) and an increase in carbon dioxide pressure greater than 45 mmHg (hypercapnia). Although advances in diagnostic techniques and intervention therapy have progressed rapidly, respiratory failure is still a cause of high morbidity and mortality rates in the treatment room intensive (Brunner & Suddarth, 2010).

According to Wiyoto (2010), if suction is not performed on patients with impaired airway clearance, these patients will experience a lack of O<sub>2</sub> supply (hypoxemia), and if O<sub>2</sub> supply is not met within 4 minutes it can cause permanent brain damage. An easy way to find out hypoxemia is by monitoring oxygen saturation (SpO<sub>2</sub>) levels which can measure how much percentage of O<sub>2</sub> the hemoglobin can carry. And data that can be obtained and health services in each province of Riau, West Sumatra and North Sumatra which says patients fail to breathe in almost every hospital that has ICU room. Starting from 2009-2013, it can be estimated that the total number of patients treated in the ICU is 1,680 and 756 patients (46.7%) have experienced respiratory failure. and it is estimated that patients treated in the ICU in each hospital are 40 patients each month and patients who experience respiratory failure Between 12 patients each month and 8 patients each month die of respiratory failure (Health Office, 2014).

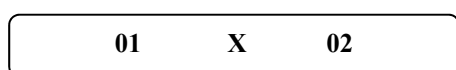
Based on preliminary surveys conducted by researchers, it is known that in the ICU room of Grandmed Hospital, in 2016 there were 72 patients who were installed with ventilators. In 2017, 86 patients were installed with ventilators. In 2018 a total of 67 patients had ventilators. The average patient who experienced respiratory failure as many as 9 patients per month, 3 patients died from respiratory failure per month. And in early 2019 who were treated in the ICU room as many as 27 patients who installed ventilators. This is what prompted researchers to conduct research on the Effect of Suctioning Mucus Measures on Oxygen Saturation in Patients with Endotracheal Tube (ETT) in the ICU at Grandmed Lubuk Pakam Hospital in 2019.

## 2 RESEARCH METHODS

This type of research is quantitative research. This study uses a Pre Experiment research design with a One Group Pretest-Posttest Design, because this study is directed to see how the Effect of Endotracheal Suction on Suction Oxygen Saturation Levels in the ICU at Grandmed Lubuk Pakam Hospital in 2019.

Location and Time of Research Research on the Effects of Endotracheal Tube Suction on Oxygen Saturation Levels in ICU at Grandmed Lubuk Pakam Hospital in 2019. The reasons researchers chose research sites are 1) No research has been conducted on the Effect of Suction of Endotracheal Tube Suction in the ICU at Grandmed Lubuk Pakam Hospital in 2019. The reasons for researchers choosing research sites are 1) Research on the Effects of Suction on Endotracheal TubeI (ETT) on Oxygen Saturation Levels in the ICU Room of the Grandmed Lubuk Pakam Hospital in 2019, b) The location of the study is close to the researcher, c) There is a problem regarding the action of mucus suctioning with changes in oxygen saturation in patients who are installed Endotracheal Tube (ETT).

The study was conducted in April to May 2019. And the population of this study were patients who installed Endotracheal Tube (ETT) in the ICU room at the Grandmed Lubuk Pakam Hospital, in April-May 2019 as many as 20 patients. The sampling technique used in this study used an accidental sampling technique where only patients who met with researchers were sampled (Hidayat, 2011). So the sample in this study is ICU patients who have Endotracheal Tube (ETT) installed at Grandmed Lubuk Pakam Hospital in April - May 2019.



Description:

01: The group before the Suction action is taken.

X: Suction Action Treatment Group

02: Group after Suction action

Figure1: Research Design

### Inclusion Criteria

- Patients who have ETT and Ventilator installed
- Patients with mucus buildup (secret) and suction will be performed
- Patients with SpO<sub>2</sub> <95%

### Exclusion Criteria

- Patients in the process of CPR (Pulmonary resuscitation)
- Patients who have Post ROSC (Return Of Spontaneous Circulation) <3 hours

The instrument used in this study is the observation sheet consisting of the respondent's general identity contained at the top of the observation sheet. While at the bottom there are results of the pre-test and post-test assessment of the action of mucus suctioning.

The procedure in this study, preliminary data about oxygen saturation levels were collected through a pre-test. Including values from the measurement results used an oximetry device. Then the respondent will be given suction action. After taking action through treatment, the final data of this study were taken through a posttest including data on oxygen saturation levels by monitoring using an oximetry device

### Collecting Data Techniques

#### Premier Data

This data was obtained based on statements in the form of observation sheets filled out by researchers that can be seen from the state of the patient while being treated in the ICU room at the Grandmed Lubuk Pakam Hospital.

#### Secondary Data

Secondary data from this research were taken from nurses and doctors to determine the diagnosis of patients while being treated in the ICU at Grandmed Lubuk Pakam Hospital.

#### Research variable

The variables of this research are :

- The independent variable (independent variable) in this research is the act of mucus suctioning
- The dependent variable (dependent variable) is the change in oxygen saturation.

### Data analysis

Processing and analysis data were done using computer software. Data analysis included univariate analysis was used to obtain a description of the distribution of research subjects of each variable from the Effect of Endotracheal Tube Suction on Oxygen Saturation Levels in ICU at Grandmed Lubuk Pakam Hospital in 2019 and to establish further data analysis.

Analysis was needed to explain or find out whether there are significant influences or differences between the independent variables and the dependent variable. Bivariate analysis was performed after the characteristics of each variable are known. From the

results of statistical calculations with the probability value (p) with a real level  $\alpha = 0.05$  with a confidence level of 95% (P Value  $< \alpha$ ) means that there is a significant relationship between the independent and dependent variables. To test the hypothesis used is to use the *Wilcoxo Test*.

**Endotracheal Tube Implementation Procedures:**

- **Tools preparation (figure 2),** A) The distal expanded portion of the suction tubing connector is cut off, B) The tip of the suction tubing is wedged into the ETT connector, C) Scissors are used to cut a proximal hole in the suction tubing, D) Scissors are used to cut a distal hole in the suction tubing, E) The stylet is passed through the distal hole in the suction tubing into the ETT, F) When suction is required, an assistant occludes the proximal hole in the suction tubing. Once the tip of the ETT is in the larynx, the suction tubing and stylet are removed together and positive pressure ventilation can be provided (Abrons, Zimmerman, El Hattab, 2017)

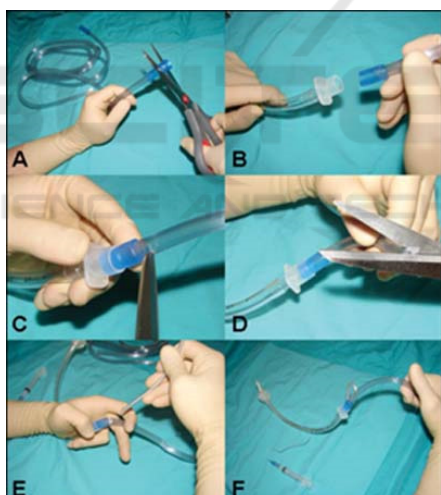


Figure 2: Construction of the ETT as a suction wand

- **Intubation installation (Figure 3):** (1) Deflate the laryngeal mask airway (LMA) cuff to a smooth low profile shape. Grasp LMA between thumb and index finger. (2) Extend the patient's head with the nondominant hand, while the LMA is inserted with thumb and index finger grip toward the hard palate. (3) Advance the LMA into position by applying pressure with the index finger along the palate. Advance until resistance is felt in the oropharynx. (4) Withdraw the dominant hand from the patient's mouth,

while stabilizing the LMA shaft with the nondominant hand. (5) Inflate the LMA cuff, often the device will move slightly out of the patient's mouth with cuff inflation. Suggested inflation pressure is 6-10 cm H<sub>2</sub>O, do not overinflate (Hernandez, Klock, Ovassapian, 2012, 2012).

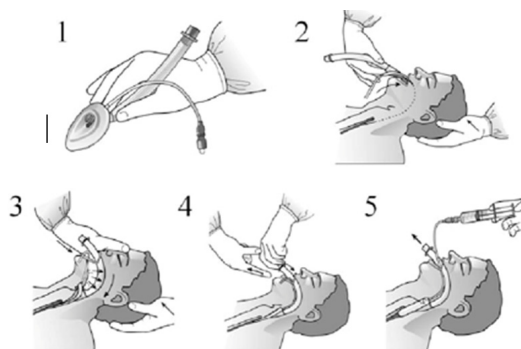


Figure 3: Manufacturer's recommended insertion technique (Courtesy of LMA North America, San Diego, CA)

- **The results of installing Endotracheal Tube in patients**



Figure 4: Pasien Endotracheal Tube

**3 RESULTS AND DISCUSSION**

Based on the results of the study in Table 1, Characteristics of respondents by gender, namely 12 men (60.0%), and 8 women (40.0%).

Table 1: Characteristics of Respondents

Characteristic	Frequency (people)	Percentage (%)
Gender		
Man	12	60,0
Woman	8	40,0
Total	20	100,0

Based on the results of the study in Table 2, Characteristics of respondents by Mucus Suction in Patients with Endotracheal Tube Installed

Table 2: Mucus Suction in Patients with Endotracheal Tube Installed

Mucus Suctioning	Frequency (Orang)	Percentage (%)
Good	2	10,0%
Deficient	18	90,0%
Total	20	100%

Based on the research results in Table 3 of the Effect of Endotracheal Tube (ETT) Suction against the Oxygen Saturation Level in the ICU in the Grandmed Lubuk Pakam Hospital in 2019, before the Suction of Endotracheal Tube (ETT) in the Good category 2 people (10.0%) and deficient category as many as 18 people (90.0%), and after the Endotracheal Tube (ETT) mucus suctioning act the good category as many as 17 people (85.0%) and deficient category as many as 3 people (15.0%) at ICU room Grandmed Lubuk Pakam Hospital in 2019.

Table 3: After the action of mucus suctioning

Mucus Suctioning	Frekuensi (Orang)	(%)
Good	17	85,0%
Deficient	3	15,0%
Total	20	100%

Based on the results of the study in Table 4 about the Effect of Endotracheal Suction (ETT) Suction on the Oxygen Saturation Level in the ICU in the Grandmed Lubuk Pakam Hospital in 2019, alteration in Oxygen Saturation Endotracheal Tube (ETT) in the Grandmed Lubuk Pakam Hospital In 2019 there were 17 good categories (85.0%), and bad mucus suctioning measures were 3 people (15.0%).

Table 4: Changes in Oxygen Saturation in Patients with Endotracheal Tube (ETT)

Alteration in Oxygen Saturation	Frequency (Orang)	(%)
Good	17	85,0%
Deficient	3	15,0%
Total	20	100%

Based on the results of the study in Table 5 This study was conducted on 20 patients treated at Grandmed Lubuk Pakam Hospital and in 209 patients on the Effects of Endotracheal Tube (ETT) Suction on the Oxygen Saturation Level in the ICU Room at Grandmed Lubuk Pakam Hospital in 2019 based on sociodemography which includes Gender, it can be seen the characteristics of respondents based on the sex of the majority of men as many as 12 people (60.0%) and the majority of women 8 people (40.0%).

Table 5: The Effects of Endotracheal Tube (ETT) Mucus Suction on Oxygen Saturation Levels

Mucus Suctioning	n	Mean	Std. Deviation	Min	Max	Value
Pre Suction	220	6,90	4.553	79	95	0,00
Post Suction	220	95,85	4.760	84	100	

According to the assumptions of research conducted by Irawan (2014) regarding the effect of endotracheal tube (ETT) suctioning action on oxygen saturation levels in patients treated in ICU room of RSUP Prof. Dr. R. D. Kandou Manado, 12 patients or about 75% of patients have male sex and 7 people (44%).

While in a study conducted by Irawan (2015) regarding the effect of suction action on changes in peripheral oxygen saturation in patients treated in the ICU room at Abdul Wahab Sjahranie Hospital Samarinda, as many as 20 people out of 26 samples taken were male and 11 were female. used as a sample having a head injury medical diagnosis.

Based on the total score of each dimension in the table above, statistical analysis of the Wilcoxon test means that  $H_0$  is rejected so there is available the effect of Endotracheal Tube (ETT) Suction on the Oxygen Saturation Level in the ICU of the Grandmed Lubuk Pakam Hospital in 2019. Easier interpretation of data is by looking at the P Value index of  $= .000 < (0.05)$ .

Therefore it can be concluded that  $H_0$  is rejected. So there is the effect of Endotracheal Tube

(ETT) Suction on the Oxygen Saturation Level in the ICU of the Grandmed Lubuk Pakam Hospital in 2019. And Distribution of Frequency and Percentage of Endotracheal Tube (ETT) Suction on the Oxygen Saturation Level in the ICU Grandmed Lubuk Pakam Hospital in 2019.

In the Saskatoon Health Regional Authority (2010) said that complications that may arise from the action of sucking mucus one of which is hypoxemia / hypoxia. And strengthened by Maggiore et al ., (2013) about the side effects of ETT mucus suctioning, one of which is that there can be a decrease in oxygen saturation levels of more than 5%. So that patients suffering from diseases of the respiratory system will be very vulnerable to experience a significant decrease in the value of oxygen saturation at the time of the action of mucus suctioning.

The results obtained from this research indicate that there are differences in oxygen saturation levels before and after mucus suctioning action is given. The results showed a decrease in the oxygen saturation level of the respondents namely the difference in the value of oxygen saturation levels by 5.174%. Besides that, from the results of the t-Test statistical test on respondents, there is a significant effect where the p-value = 0,000 ( $\alpha < 0.05$ ).

According to the assumptions of the research conducted by Maggiore, et al (2013), about *Decreasing the Adverse Effects of Endotracheal Suctioning During Mechanical Ventilation by Changing Practice*, where 46.8% of respondents experienced a decrease in oxygen saturation and 6.5% due to suction. Based on these studies it can be concluded that the action of suction can cause a decrease in oxygen saturation levels.

According to the assumptions of research conducted by Maulidia, Rosina (2017), the effect of mucus suction action on changes in oxygen saturation levels in critical patients treated in the ICU room at An-Nisa Hospital in Tangerang with a mean value obtained is 1.475 with a standard deviation of 1.358 and the mean standard error of 0.215. The P value obtained in this study is 0,000 ( $\leq 0.05$ ), so it can be concluded that there is an effect of suctioning on changes in oxygen saturation levels in critical patients treated in the ICU at An-Nisa Hospital Tangerang.

Based on the research conducted, the researcher's assumption is that before 2 people (10.0%) Good category of Endotracheal Tube (ETT) mucus suction and 18 people (90.0%) less good category, and after mucus suctioning Endotracheal Tube (ETT) Good category as many as 17 people (85.0%) and Poor category as many as 3 people

(15.0%) in the ICU Room Grandmed Lubuk Pakam Hospital in 2019.

The experts recorded a 24% respiratory failure rate with a 33.33% mortality rate. Mucus suction is one of the components and bronchial toilets for aspiration of mucus on clients with artificial airways. Suctioning mucus (Suction) is the act of cleaning the airway through an artificial airway using a suction catheter and a suction device (Wilson, 2010).

And distribution of Frequency and Percentage Change in Oxygen Saturation in Patients with Endotracheal Tube (ETT) in the ICU of Grandmed Lubuk Pakam Hospital in 2019.

According to the assumptions of research conducted by Marlisa, Idjradinata, Kosasih (2013) about the effect of oxygen supply through the catheter mouth during suction on oxygen saturation in ventilator head mounted patients, where the use of catheter mouth is more effectively used during suction to reduce the risk of decreasing saturation oxygen in patients with severe head injury with ventilators compared with those not using catheter mouth.

According to the assumptions of research conducted by Nizar, Haryati (2015) the results of this study indicate an increase in oxygen saturation levels after suction. That is because the free airway to accumulate secretions makes oxygen transfer from the atmosphere into the lungs effective. Therefore the researcher took suction action on the respondent in accordance with the inclusion criteria based on standard operating procedures.

Based on the research conducted, the researcher's assumption is that the Oxygen Saturation Change in Endotracheal Tube (ETT) patients in the ICU Room in the Grandmed Lubuk Pakam Hospital in 2019 is good for 17 people (85.0%), and changes in oxygen saturation are as good as 3 people (15.0%).

Frequency Distribution and Percentage Effect of Endotracheal Tube (ETT) Mucus Suction Actions on Oxygen Saturation Levels in ICU in Grandmed Lubuk Pakam Hospital in 2019.

According to the assumptions of research conducted by Bayu (2013) regarding the effect of suction action on changes in peripheral oxygen saturation in patients treated in the ICU room Abdul Wahab Sjahranie Hospital Samarinda, before the action of mucus suctioning, a mean value of 93.65 and a median of 94, with a standard deviation of 1,623, a minimum value of 90 and a maximum saturation level of 96. After mucus suctioning, a mean of 97.46 and a median of 98, obtained a standard deviation of 1.606 with a minimum value of 94 and a maximum of 100.9.

Based on the research assumptions of Kitong, Mulyadi, & Malara (2014) entitled "The effect of the action of aspiration of endotracheal tube mucus (ETT) on oxygen saturation levels in patients treated in ICU room of RSUP Prof. DR. D. Kandou Manado" which shows the differences in oxygen saturation levels before and after given mucus suctioning action where there is a difference in the value of saturation levels of 5.174% and  $p$ value = 0,000 ( $\alpha < 0.05$ ).

Based on the total score of each dimension in the table above, statistical analysis of the Wilcoxon test means that  $H_0$  is rejected so that there is an Influence of Endotracheal Tube (ETT) Suction on the Oxygen Saturation Level in the ICU of the Grandmed Lubuk Pakam Hospital in 2019. Easier interpretation of data is by looking at the  $p$  value index of  $= .000 < (0.05)$ . Therefore it can be concluded that  $H_0$  is rejected. So there is the effect of Endotracheal Tube (ETT) Mucus Suction Act on the Oxygen Saturation Level in the ICU in Grandmed Lubuk Pakam Hospital in 2019. The action of mucus suctioning performed on patients with ventilators installed at Grandmed Hospital has an effect on changes in oxygen saturation in the ICU at Grandmed Lubuk Hospital in 2019..

The obstacle found in this study is the uniformity in using suction cannula size is not the same, because the size is different so that it affects the difference in the value of oxygen saturation in patients with suctioning measures. The size of a larger suction cannula (14 Fr) can reduce Oxygen Saturation levels more than the smaller size (12 Fr). Another obstacle found in this study is regarding the level of education and tenure of nurses who perform suctioning actions. This can have an indirect effect on nurses' skills in performing suctioning actions.

#### 4 CONCLUSION

For Bivariate analysis was got the results obtained based on the Wilcoxon test have a significant difference between before and after the results. The value before the suction action includes the mean value is 86.90%, the standard deviation value is 4.553%, the minimum value is 79%, the maximum value is 95%, and the value after suction action includes: the mean value is 95.85%, the standard deviation value is 4760%, the minimum value is 84%, the maximum value is 100%. Then conclusions There is an influence before and after the suction action on the value of oxygen saturation ( $p < 0.005$ ), so that  $H_0$  is accepted.

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