

ORIGINAL ARTICLE

Techniques Closed Suction Influence on Oxygen Saturation In Patients Using Mechanical Ventilation In Intensive Care Unit Room

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ABSTRACT

Introduction: The problem in patients who are intubated with endotracheal tube is the occurrence of accumulation of secretions. One of the actions to reduce the secretion is closed suction. This research monitors the patient's oxygen saturation and also reveals the effect of closed suction on oxygen and AaDO₂ saturation (alveolar-arterial oxygen difference) in patients who were mechanically ventilated in the Intensive Care Unit (ICU) of Dr. Kariadi Hospital. The design of this study uses pre experiment. **Methods:** The research process has been carried out on April 2, 2019 until May 26, 2019 in the Intensive Care Unit with a total sampling technique, on 15 respondents. **Result:** The results of the study showed that there was effect of closed suction technique on the value of oxygen saturation in patients with mechanical ventilation (p-value = 0.010). **Conclusion:** Closed suction can lead to decrease of air volume in the lungs up to 1200 ml. So hyperoxygenation must be done before closed suction as it can reduce the incidence of hypoxemia by 49%. Before closing the suction, it is recommended to do hyperoxygenation.

Keywords: Closed suction, Oxygen saturation, Mechanical ventilation

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INTRODUCTION

One of the criteria for admission to the ICU for critically ill, unstable patients who require intensive and titrated therapy such as ventilator support / support of other organ/ system supportive aids, infusion of continuous vasoactive drugs, continuous antiarrhythmic drugs, continuous titrated treatment, for example post cardiothoracic surgery, severe sepsis patients, impaired acid-base balance and life-threatening electrolytes (1). This includes patients with respiratory failure who need help with mechanical ventilation and need an endotracheal tube or tracheotomy. Installation of endotracheal tubes in intensive care units is necessary for the benefit of airway management (2).

Respiratory failure is the incapacity of the respiratory system to continue normal blood oxygenation (PaO₂), removal of carbon dioxide (PaCO₂) and adequate pH caused by ventilation, diffusion or perfusion problems. Based on data on rank 10 non-communicable diseases which cause fatal deaths based on Case Fatality Rate

(CFR) in cases of hospitalization in 2010, the incidence of respiratory failure ranks second with 20.98% cases (3). According to the data on the number of patients treated in the Intensive Care Unit (ICU) room at the General Hospital Dr. Kariadi Semarang, between June 2018 and August 2018) out of 214 patients 56 patients were treated without breathing aids / ventilators and 158 patients were installed with a ventilator. While the patients who installed the ventilator consisted of 33 patients using closed suction and 125 patients using open suction.

Mechanical ventilation is a supportive therapy that serves to help patients those are unable to breathe oxygen adequately and eliminate carbon dioxide (4). The problem in patients who have been intubated with endotracheal tube is the accumulation of secretions. For that we need to take action to clean the airway with suction. Suction is a way to remove secretions from the airways by using a catheter that is inserted through the nose or oral cavity into the pharynx or trachea (5). Abbasinia et al., (2014) found during Endotracheal Tube (ETT) suctioning there is significant drop in SpO₂ after each suctioning (6).

Preliminary studies conducted by researchers in the Intensive Care Unit (ICU) of RSUP Dr. Kariadi Semarang,

after suction using closed suction in 3 patients with ventilators, 2 patients experienced a 1% decrease in SpO₂ and 1 patient did not experience a decrease in SpO₂. Based on the above phenomenon, researchers are interested in conducting research on the effect of closed suction techniques on oxygen saturation in patients with mechanical ventilation in the Intensive Care Unit (ICU) of Kariadi Hospital, Semarang.

MATERIALS AND METHODS

Here quantitative theory was used by pre-experimental research design. The research process was carried out on April 2, 2019 to May 26, 2019 in the Intensive Care Unit (ICU) of RSUP Doctors Kariadi Semarang with a total sampling technique of 15 respondents. Ethical approval for this study was obtained from the Ethical Review Board for Health Research Ethics Committee Dr. Kariadi Hospital Semarang (Reference No 239/EC/KEPK-RSDK/2019). Data were analyzed univariately and bivariately (Wilcoxon Test).

RESULTS

The results showed that the average age of respondents was 40 years, the youngest was 19 years and the oldest age was 78 years. Most of the sex of the respondents were women as much as 53.30% and the most medical diagnoses were patients with Chronic Kidney Disease (CKD) amounting to 20%.

Based on Table I it can be seen that the average oxygen saturation before using closed suction was 98.53% and oxygen saturation after using closed suction was 97.73%. There was a decrease of 0.80%.

Table I: Oxygen saturation values before and after suction using closed suction in the Intensive Care Unit (ICU) of RSUP Dr. Kariadi Semarang April - May 201 (n = 15)

Variable	Mean	Median	Min	Max	SD
oxygen saturation pre-test (%)	98.53	99.00	94.00	100.00	1.81
oxygen saturation post-test (%)	97.73	98.00	92.00	100.00	2.31

Based on Table II after bivariate test using non-parametric analysis Wilcoxon test (because the two data distribution variables are not normal), it can be seen that there are differences in oxygen saturation values before and after using closed suction in patients who are fitted with mechanical ventilation in the Intensive Care room Dr. RSU Unit (ICU) Kariadi Semarang (Z-score =

Table II: Test different oxygen saturation values before and after suction using closed suction in patients who are fitted with mechanical ventilation in the Intensive Care Unit (ICU) RSUP Dr. Kariadi Semarang April - May 201 (n = 15)

Variable	Z-score	p-value
Oxygen saturation	-2.585	0.010

-2.585, p-value = 0.010). Wilcoxon Test Results p-value <α (0.05), it can be concluded that there is an effect of closed suction technique on oxygen saturation values in patients who are installed with mechanical ventilation in the Intensive Care Unit (ICU) of RSUP Dr. Kariadi Semarang.

DISCUSSION

Closed suction system is a technique to remove secretions from the tracheo-bronchial branches in patients who need mechanical ventilation without removing the ventilator circuit. During suction, there is a change in pressure in the atmosphere. The advantage of this closed suction method is that it maintains positive ventilation pressure, oxygen supply, and positive end expiratory pressure (PEEP). Cannula with a closed system is always connected to the ventilator. So, when this is used there is no need to open the connector, so the incoming air flow is not interrupted. Giving oxygen therapy to patients is important to prevent the occurrence of hypoxia which will may cause death within 5 minutes of onset of hypoxemia.

Similar research on the use of suction techniques with the open suction method, showed that there was a significant difference in oxygen saturation after suction with a pressure of 100 mmHg, 120 mmHg and 150 mmHg(7). The use of a 100 mmHg suction pressure has been shown to cause the most minimal decrease in oxygen saturation when compared with 120 mmHg and 150 mmHg pressures. The role of suction pressures (100 mmHg, 120 mmHg and 150 mmHg) does not cause a decrease in oxygen saturation >5%. It is better to do hyperoxygenation for 1-3 minutes before and after suctioning to prevent a decrease in oxygen saturation in less than 95% cases. One phase of suctioning in adult patients should not exceed 15 seconds because it will cause a decrease in patient saturation of less than 95%.

The results of the study also suggest further research is necessary to see the relationship between PEEP and suction pressure in the close suction technique to oxygen saturation in patients who are attached to a ventilator. Other studies have compared the efficacy of closed suction systems (CSS) and open systems (OSS) and their side effects on gas and hemodynamic exchange. The results showed that open suctioning (OSS) was more effective than closed suctioning (CSS) (8).

Research conducted (9) about the action of hyperoxygenation revealed that hypoxemia can reduced before suctioning with the help of 32% suction, while hyperoxygenation done before and after suctioning can decrease the level of hypoxemia with the help of suctioning 49%. Previous research on the use of 100 mmHg suction pressure caused lung air volume loss up to 1200 ml, especially by using open suction techniques(10), as well as research on the use of 150

mmHg suction pressure can cause lung air loss of 1.281 + 656 ml(11). The greater the suction pressure, the greater the amount of air inhaled from the lungs, this will have an impact on decreasing the amount of oxygen that will diffuse from the alveoli to the pulmonary capillaries and bind with hemoglobin which will then cause a decrease in the value of oxygen saturation.

The application of 100 mmHg suction pressure can be performed on each suctioning, especially in patients whose saturation value is 97-100%, because the suction pressure of 100 mmHg can only reduce oxygen saturation by 2%. The application of 120 mmHg suction pressure can be used in patients with oxygen saturation of 99-100%, because use of this pressure can reduce oxygen saturation up to 4% and suction pressure of 150 mmHg can be applied at 100% oxygen saturation, because in this reduces oxygen saturation up to 5%. If there are patients who have oxygen saturation values <95% despite hyperoxygenation and suctioning must be performed because there is mucus in the airways, then 100 mmHg suction pressure can be used to evacuate the secretions in the airways as well as decreased the risk of oxygen saturation that results from suctioning.

The presence of suction pressures of 100 mmHg, 120 mmHg and 150 mmHg, affects the ability of mucus evacuation on the airway. This can be seen in the number of suction phases carried out in one suction period. Using the 100 mmHg suction pressure, the number of suction phases is 3-4 times (66.7%) at the most, in one mucus evacuation period. In the use of 120 mmHg suction pressure, the highest number of suction phases is 3-4 times (61.9%) in one mucus evacuation period. Using 150 mmHg suction pressure, the highest number of suction phases is 1-2 times (90.5%) in one mucus evacuation period. It can be seen that the greater the suction pressure used, the lower the number of suction phases needed in one mucus evacuation period. It is proved that during use of negative suction pressure, if the negative pressure will increase the ability to transport (removal) of the mucus from the airway also increase but during this open suction technique lung volume loss also increase ($p = 0.02$)(12).

Other studies recommend that the number of phases in one mucus evacuation period must be no more than 3 times because it will potentially increase complications from suction including trauma to the airway mucosa(13). Likewise it is recommended that not more than three suction phases must be done in one episode of suctioning because it can cause injury to the airways. Before suctioning, changes in oxygen saturation and AaDO₂, is a major sign. Indication of the mucus saturation in the airways, which cause the decrease in tidal volume as well as decrease in oxygen saturation, can cause patient suffering with an increase in frequency of breathing and higher heart rate (14,15).

CONCLUSION

As per the analysis of the results of the study and the discussion above, it can be concluded that there is an effect of closed suction technique on the value of oxygen saturation in patients who are fitted with mechanical ventilation in the Intensive Care Unit (ICU) of RSUP Dr. Kariadi Semarang (Z-score = -2.585, p-value = 0.010). Based on these results it is suggested that closed suction technique can be used as a reference in the management of patients who are fitted with mechanical ventilation, especially when doing closed suction hyperoxygenation is first performed to anticipate the occurrence of hypoxemia.

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