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ORIGINAL RESEARCH

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COMPARISON OF THE EFFECTIVENESS OF TWO LEVELS OF SUCTION PRESSURE ON OXYGEN SATURATION IN PATIENTS WITH ENDOTRACHEAL TUBE

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Abstract

Background: Endotracheal suctioning is one of the common supportive measures in intensive care units (ICU), which may be related to complications such as hypoxia. However, a questionable efficacy is still identified to choose suctioning pressure between 130 mmHg and 140 mmHg that is effective for patients with endotracheal tube.

Objective: To compare the effectiveness of 130 mmHg and 140 mmHg suctioning pressure on oxygen saturation in patients with endotracheal tube.

Methods: This research used a quasi-experimental design with pretest and posttest group. The study was conducted from 31 January to 1 March 2017 in the Hospital of Panti Wilasa Citarum and Hospital of Roemani Muhammadiyah Semarang Indonesia. There were 30 samples recruited using consecutive sampling, with 15 assigned in the 130 mmHg and 140 mmHg suctioning pressure group. Pulse oximetry was used to measure oxygen saturation. Paired t-test and Independent t-test were used for data analysis.

Results: Findings showed that there was a statistically significant effect of 130 and 140 mmHg suctioning pressure on oxygen saturation in patients with endotracheal tube with p-value <0.05. There was a significant mean difference of oxygen saturation between 130 mmHg and 140 mmHg suctioning pressure group with p-value 0.004 (<0.05). The mean difference of oxygen saturation between both groups was 13.157.

Conclusion: The 140-mmHg suctioning pressure is more effective compared with 130 mmHg suctioning pressure in increasing oxygen saturation in patients with endotracheal tube.

Keywords: endotracheal tube; pressure suction; oxygen saturation

INTRODUCTION

Suction is the act or process of sucking on the airway performed on patients with excess sputum production where patients are unable to do it alone ([Hudak & Gallo, 2010](#)). Suction is often performed in critical patients treated in intensive care, especially in patients with endotracheal tube (ETT) entering into the bronchial branching of the airways ([Hudak & Gallo, 2010](#)). In addition, the action of suctioning of mucus is done with pressure and duration of certain suction. Suction pressure is distinguished by age, for adults the suction

pressure is 100-140 mmHg, for children 95-100 mmHg and for infants 50-95 mmHg with duration of 10-15 seconds, while the size of suction catheter is adjusted based on the size of endotracheal tube ([Timby, 2009](#)).

Endotracheal suction is one of the most common nursing actions in the Intensive Care Unit (ICU). Patients may require suction 3 times a day. Therefore, suction should be carefully implemented. Complications that may arise from suctioning include hypoxemia,

airway trauma, nosocomial infections and cardiac respiratory artery dysrhythmias, hypertension or hypotension, bronchospasm, pulmonary bleeding, pain and anxiety ([Kozier, Erb, Signs, Prevention, & Oral, 2002](#)).

The results of Putri's study showed that the suction pressure of 130 mmHg was more effective than the suction pressure of 110 mmHg ([Putri, 2015](#)). Supported by Kitong's study revealed that 13-14 patients using endotracheal tube month showed an increase in oxygen saturation ([Kitong, Mulyadi, & Malara, 2014](#)), however, 50% of ignorance of the suction procedure and often the implementation is not in accordance with existing procedures.

Endotracheal Tube (ETT) intubation is a way of breathing for patients who cannot maintain adequate airways (patients with airway obstruction), for mechanical ventilation, and for suctioning of bronchial secretions ([Kozier et al., 2002](#)). Kitong stated that a decrease of SpO₂ in size of 12 Fr is more effective than the size of 14 Fr with ETT number of 7 mm. If suction is not done in patients with airway obstruction then the patient will experience hypoxemia, and if O₂ supply is not met within 4 - 6 minutes it can cause damage to permanent brain cells ([Kitong et al., 2014](#)). An easy way to find out hypoxemia is by monitoring oxygen saturation (SpO₂) levels that can measure how much of the O₂ percentage can be carried by hemoglobin. Monitoring oxygen saturation levels is by means of pulse oximetry. By monitoring proper and correct oxygen saturation levels during mucus sucking, the hypoxemia case that can cause respiratory failure to life-threatening leads to death can be prevented earlier.

Oxygen saturation is a measure of how much oxygen percentage that hemoglobin can carry ([Kozier et al., 2002](#)). Pulse oximetry is a non-invasive tool that measures the oxygen saturation of arterial blood of patients placed on the fingertips, thumb, nose, ear or forehead and pulse oximetry to detect hypoxemia before signs and symptoms appear.

An effort to minimize the desaturation of oxygen is by way of choosing the use of pressure, duration and suction the right catheter. Pressure suction used in this research is 130 mmHg and 140 mmHg, and this fits with the standard procedure of the Roemani Muhammadiyah hospital of Semarang. This study aimed to examine the effectiveness of 130 mmHg suctioning pressure compared with 140 mmHg on oxygen saturation in patients with endotracheal tube.

METHODS

Research Design

This research used a quasi-experimental design with pretest and posttest group.

Setting

The study was conducted from 31 January to 1 March 2017 in the Hospital of Panti Wilasa Citarum and Hospital of Roemani Muhammadiyah Semarang.

Sample

The target population in this study was all patients treated in the ICU of the Hospital of Panti Wilasa Citarum and Hospital of Roemani Muhammadiyah Semarang. Consecutive sampling was used to select the sample in this study, and there were 30 samples recruited, with 15 assigned in the group of 130 mmHg suctioning pressure and the group of 140 mmHg pressure. The inclusion criteria of the sample included: patients with endotracheal tube size of 7.0 mm, aged > 25 years; while the exclusion criteria were: patients with unstable hemodynamics and with cardiac arrest.

Intervention

The intervention was given by the researcher using a suction central that has pressure regulator in mmHg pressure size unit according to standard procedure of suction with 12F suction size, with duration of 10-15 seconds with pressure of 130 mmHg and 140 mmHg. The researcher was assisted by enumerators who had diploma nursing background and certification in ICU. The procedure of suctioning included: 1) explain the patient about the purpose of the action to be performed, 2) preparing the tools, 3) washing hands, 4) adjusting the patient's

position as comfortable as possible, 5) cleaning the thumb / one finger with alcohol, 6) connecting the probe to the patient's finger to be installed, 7) pressing power standby – ON, 8) pressing the calibration system, 9) recording the results on nursing sheet, 10) pressing power standby-OFF, 11) removing the probe from the patient, 12) preparing the tools in place, and 13) washing hands.

Instrument

Oxygen saturation in this study was measured using pulse oximetry. The normal value of oxygen saturation is $\geq 95 - 100\%$. If oxygen saturation $<95\%$, then it is categorized as bad category.

Ethical Consideration

This research has met the requirements or ethical conduct of Health Research Commission of POLTEKKES Semarang with number: 288 / KEPK / Poltekkes-Smg / EC / 2016. Prior to data collection, the researcher gave an explanation to the respondents about the objectives, benefits, and risks that might arise in the research. Once the respondents agreed, then they were asked to sign an appropriate informed consent.

Data Analysis

Paired t-test was performed to analyze the effect of interventions on oxygen saturation, and Independent t-test was to analyze the difference between 130 mmHg and 140 mmHg suctioning pressure.

RESULTS

Table 1 shows that the mean difference of oxygen saturation before and after given 130 mmHg suction was -1.133 with p-value 0.006 (<0.05), indicated that there was a statistically significant effect of 130 mmHg suctioning pressure on oxygen saturation; and the mean difference of oxygen saturation before and after given 140 mmHg suction was -2.467 with p-value 0.000 (<0.05), indicated that there was a statistically significant effect of 140 mmHg suctioning pressure on oxygen saturation in patients with ETT.

Table 1 also shows that the mean difference of oxygen saturation in 140 mmHg group was higher than the mean in 130 mmHg group. It could be said that 140 mmHg suctioning pressure was more effective than 130 mmHg suctioning pressure.

Table 1 Effect of 130 mmHg and 140 mmHg suctioning pressure on oxygen saturation using Paired t-test

	Mean	T	Sig. (2-tailed)
SpO ₂ Pre-Posttest (130 mmHg)	-1.133	-3.238	0.006
SpO ₂ Pre-Posttest (140 mmHg)	-2.467	-10.435	0.000

Table 2 Difference of oxygen saturation before and after given 130 mmHg and 140 mmHg suctioning pressure using Independent t-test

Oxygen saturation	T	Df	Sig.(2-tailed)
Mean difference of SpO ₂ between 130 mmHg and 140 mmHg suctioning pressure	-3.157	28	0.004

Independent t-test as shown in the Table 2 obtained p-value 0.004 (<0.05), which indicated that there was a significant mean difference of oxygen saturation between 130 mmHg and 140 mmHg suctioning pressure group. The mean difference of oxygen saturation between both groups was 13.157.

DISCUSSION

The aim of this study aimed to compare the effectiveness of 130 mmHg and 140 mmHg

suctioning pressure on oxygen saturation, and findings of this study revealed that there was a significant effect of 130 mmHg and 140 mmHg suctioning pressure on oxygen saturation in patients with endotracheal tube with p-value <0.05 .

Before given intervention, both groups have low oxygen saturation, with 8 respondents (26.7%) in the 130-mmHg group and 7 respondents (23.3%) in the 140-mmHg group.

This condition is due to the secret accumulation on the patient's airway. Inadequate airway will cause the supply of oxygen to the lungs reduced, so that oxygen to be channeled throughout the body through blood vessels is also reduced, as well as low oxygen received by peripheral, thus low saturation of oxygen (SpO₂) is detected in pulse oximetry ([Kartikawati, 2011](#)).

Findings of this study showed that 130 mmHg suctioning pressure gave a significant effect on oxygen saturation, but it was less effective due to its pressure was unable to eliminate the secret as a whole so that secret still obstruct the patient breathing. For 140 mmHg suctioning group, after given intervention, there were 14 respondents (46.7%) had good oxygen saturation. This shows a significant increase in oxygen saturation because 140 mmHg pressure reduces the secret so that the patient's airway is clear and contains more oxygen supply to the periphery. It could be said that an appropriate pressure, 140 mmHg in this study, increase airway clearance so that the supply of oxygen to the peripheral effective and increase the levels of SpO₂.

The results also showed that the average of oxygen saturation (SpO₂) in the 140-mmHg group before intervention was 95.60% and after intervention increased to 98.07%; and the average of oxygen saturation (SpO₂) in the 130-mmHg group before intervention was 94.73% and after intervention increased to 95.87%. Thus, 140 mmHg suctioning pressure is more effective than the 130-mmHg suctioning pressure to increase the oxygen saturation (SpO₂).

This is in contrast with Putri's study revealed that 130 mmHg suctioning pressure is effective in increasing oxygen saturation ([Putri, 2015](#)). However, that study compared with 110 mmHg, which is then concluded that 140 mmHg is more effective than 130 mmHg and 110 mmHg suctioning pressure.

CONCLUSION

There was a significant effect of 130 mmHg and 140 mmHg suctioning pressure on oxygen saturation. However, 140 mmHg suctioning pressure is more effective compared with 130 mmHg suctioning pressure in increasing oxygen saturation in patients with ETT.

Declaration of Conflicting Interest

None declared.

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Author Contribution

All authors contributed equally in this study.

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