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COMPARISON OF POSITIONING BETWEEN SEMI-FOWLER'S AND LEFT LATERAL TO OXYGEN SATURATION IN VENTILATED PATIENTS: A QUASI-EXPERIMENTAL STUDY

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Abstrak

Latar Belakang: Penempatan pasien secara teratur di ICU diperlukan untuk mencegah komplikasi. Pemberian posisi tubuh dapat mempengaruhi perkembangan paru dan dinding toraks yang mempengaruhi volume paru dan pertukaran gas. Pasien yang menggunakan ventilator memerlukan pemantauan yang intensif, salah satunya adalah saturasi oksigen. Tujuan penelitian: untuk mengetahui perbandingan posisi elevasi kepala semi fowler 300 dan elevasi lateral kiri kedua kepala 300 terhadap peningkatan saturasi oksigen pada pasien yang terpasang ventilator di ICU RS Dustira. Metodologi: quasi eksperimen menggunakan pretest-posttest with control group. Jumlah sampel sebanyak 30 pasien yang terbagi menjadi 15 pasien pada posisi 300 semi fowler dan 15 pasien pada posisi lateral kiri dengan Head Elevations 30º. Data saturasi oksigen diukur menggunakan pulse oximetry untuk semua kelompok. Intervensi dilakukan 30 menit tiga kali sehari. Analisis data dilakukan secara univariat dan bivariat dengan uji T. Hasil temuan: Hasil penelitian menunjukkan perbedaan saturasi oksigen yang signifikan sebelum dan sesudah intervensi. Posisi semi fowler dengan elevasi kepala 300 (P value = 0,000) dan posisi lateral kiri dengan elevasi kepala 300 (P value = 0,000). Kesimpulan Hal ini dibuktikan pada posisi semi-Fowler dan lateral kiri yang meningkatkan saturasi oksigen dengan nilai p 0,000 (<0,005). Saran : Perawat di ICU dapat menerapkan hasil penelitian ini sehingga dapat mendukung penyembuhan dan meminimalisir kejadian komplikasi lebih lanjut pada pasien.

COMPARISON OF POSITIONING BETWEEN SEMI-FOWLER'S AND LEFT LATERAL TO OXYGEN SATURATION IN VENTILATED PATIENTS: A QUASI-EXPERIMENTAL STUDY

Keywords:
semi fowler 30º, left lateral positions, 30º head elevations, oxygen saturation, ICU

Abstract

Background: *Regular patient positioning in the ICU is needed to prevent complications. Giving the position of the body can affect the development of the lung and thoracic wall which affects lung volume and gas exchange. Patients on ventilators need an intensive monitoring, one of which is oxygen saturation.* ***The research objective****: to determine the comparison of positioning of the semi-fowler head elevation of 30º and left lateral both head elevation of 30º to the increase in oxygen saturation in patients on a ventilator in the ICU Dustira Hospital.* ***Methodology****: quasi experiment use pretest- posttest with control group. The total of sample was 30 patients divided into 15 patients in the 30º semi-fowler's position and 15 patients in the left lateral with 30º Head Elevations. Oxygen saturation data was measured using pulse oximetry for all groups. The intervention was carried out 30 minutes three times a day. Data analysis was univariate and bivariate with T test.* ***The results finding****: The result showed a significant difference in oxygen saturation before and after interventions. The semi-fowler position with a head elevation of 30º (P value = 0,000) and*

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the left lateral position with a head elevation of 30^0 (P value = 0.000). ***Conclusion*** *This is evidenced in both semi-Fowler and left lateral positions increasing oxygen saturation with a p-value of 0.000 (<0.005).* ***Suggestion****: Nurses in the ICU can apply the results of this study so that they can support healing and minimize the incidence of further complications in patients.*

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Background

Respiratory failure is still a cause of high morbidity and mortality in intensive care unit. It resulted in the inability of the respiratory system to maintain oxygen (O_2) homeostasis and carbon dioxide (CO_2) (Smeltzer & Bare, 2017).

The incidence of respiratory failure in Indonesia is the second leading cause of death based on *Case Fatality Rate* (CFR) in hospitalization that is equal to 20.98% (Kemenkes, 2012). The average patient admitted to the ICU was 41-42 patients per month and who experienced respiratory failure was 13-14 patients per month. Approximately 10-11 patients die due to respiratory failure (Kitong, 2013). Data of medical record patient in ICU Dustira Hospital Cimahi on January-December 2019 exposed the total number of patients treated was 1015 patients and who run into respiratory failure as many as 343 patients (33,8%). The average patient admitted to the ICU was 85 patients per month and those who have respiratory failure were 29 patients (Medical Record Dustira Hospital, 2019).

Some cases of respiratory failure patients end up with mechanical ventilation which aims to help or take over respiratory function (Price & Wilson, 2012). The patients on mechanical ventilators in intensive care required close observation including by examining blood gas analyzes, specifically pH, PO_2, PCO_2, HCO_3, base excess (BE) and oxygen saturation (Huddak & Galoo, 2011). Monitoring of oxygen saturation values can be measured both invasive and non-invasive. Invasively through blood gas analysis and non-invasively by pulse oximetry. Continuous monitoring may help observe the patient's stability and provide direct information about lung function, especially to detect changes in oxygenation, ventilation, and acid-base status (Andriani & Hartono, 2013)

The normal value for oxygen saturation is 95% to 100%, The patient is declared respiratory failure if the oxygen saturation value is below 90%. An oxygen saturation value below 85% indicates that the tissue is not getting enough oxygen and less than 70% reflects a life-threatening condition for the patient (Nursecerdas in Andriani & Hartono, 2013).

One way to intensify oxygen saturation is by adjusting the patient's position because it can facilitate adequate breathing. Body position such as Semi fowler's, right or left lateral position affect the lung and the thoracic wall expansion with the result that oxygen flow better to all over the body (Ignativicius & Workman, 2016). The most effective for people with shortness of breath is the semi-Fowler's position. This position enhances the lung expansion so that oxygen is easier to enter the lungs and optimal breathing patterns. The Semi Fowler's position (30^0-45^0) utilizes gravity to help expand the chest and reduce abdominal and diaphragmatic pressure. In this position, the diaphragm will be pulled down result in the chest expansion and the lung ventilation are maximized (Kozier et al, 2011).

Meanwhile, Rodney stated that the left lateral position may improve a ventilation where the anatomy of the heart is on the left chest between the top and bottom of the lungs. This situation makes the pulmonary pressure increase and the arterial pressure at the apex is lower than at the base of the lung. Low arterial pressure causes a decrease in blood flow in the capillaries at the apex, while the capillaries at the base distend and increase blood flow. In patients on mechanical ventilation, the effect of gravity on the blood capillaries causes an increase in alveolar pressure result in increasing ventilation (Rodney in Karmiza, et al., 2014). In this position the blood flow to the lower lungs is around 60-65% of the total blood flow to the lungs (Hudak & Gallo, 2011).

There are various studies that discuss the benefits of positioning to overcome respiratory problems in patients. A study by (Abd El-Moaty, EL-Mokadem, & Abd-Elhy, 2017) declare that the semi-Fowler's position on oxygenation and hemodynamic status in patients with head injuries affect an oxygen flow. The study showed that the

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semi-Fowler's position with an elevation of 30° had a positive impact on breathing specifically the result that PaO_2, SaO_2, and respiration increased and $PaCO_2$ decreased.

The results of a preliminary study with a week of observation at Dustira Hospital from January 25-31, 2019 on three patients who were on a ventilator. Nurses did not take perform to change position on regularly basis, even though there were already Standard Operating Procedures (SOPs) and these interventions are not routine and unscheduled. In their opinion, positioning measures are more aimed at preventing pressure sores or Ventilator Associated Pneumonia (VAP). In addition, the action of changing the position is only carried out in patients with a risk of pressure ulcers and who have pressure ulcers. It was recorded that from 3 patients who have position changes, the oxygen saturation value rose from 89-92% to 94-100%, the patient felt comfortable and hemodynamically stable.

Referring to the problems above, a study is needed to analyze the comparison of giving the semi-Fowler position 30^0 and left lateral with a head elevation of 30^0 to the increase in oxygen saturation in patients on ventilators in the ICU.

This study aims to determine the comparison of positioning the semi-Fowler with a head elevation of 30^0 and left lateral with a head elevation of 30^0 to the increase in oxygen saturation in patients on ventilators in the ICU.

Methodology

The type of research is quantitative in the form of a quasi-experimental design using a pretest-posttest design with control group. This study consists of two groups that are one group in the Semi Fowler's position with a head elevation of 30^0 and others in left lateral with a head elevation of 30^0. Observation was carried out 2 times, before and after intervention. Observations before the experiment (O1) are called pre and observations before the experiment (O2) are called post.

The population in this study were patients in the ICU of Dustira Hospital Cimahi who were treated for at least 1 day and had mechanical ventilation installed with an average number of 85 patients per month and indications of respiratory failure an average of 29 patients per month. The study used a sample of 30 patients, of which 15 patients were given a semi-Fowler position with a head elevation of 30^0 and 15 patients were given a left lateral position with a head elevation of 30^0. The sampling technique in this study is non-probability sampling in the form of purposive sampling

Inclusion criteria in this study: patients who are on a ventilator with a ventilator mode other than control (volume control pressure control), does not have contraindications to head elevation position 300 (such as post-operative abdomen/thorax, pelvic fracture), patients who are not agitated, patients who do not use inotropic drugs, patients who do not use analgesics and opium sedation drugs (morphine). Exclusion criteria in this study: spinal cord injury, post craniotomy and craniectomy with increased intracranial pressure, pediatric and elderly patients.

The data collection technique in this study used observation and intervention techniques which were carried out in May-July 2020 in the ICU Room of Dustira Hospital Level II.

Primary data was obtained through observation and measurement of oxygen saturation before and after interventions and secondary data was found from medical record data.

Univariate analysis was presented in the frequency distribution table. Bivariate analysis using paired sample t test (dependent t test).

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Result

Table 1 Frequency of characteristics of patients who are on a ventilator in the ICU of Dustira Cimahi Hospital for the May-July 2020 period

No	Characteristics of Respondents	f	%
1	Age range (year)		
	26-35	2	6,7
	36-45	5	16,7
	46-55	3	10,0
	56-65	20	66,7
	Total	30	100
2	Gender		
	Male	17	56,7
	Female	13	43,3
	Total	30	100
3	Medical Diagnosis		
	CHF	2	6,7
	CKD	5	16,7
	AMI	2	6,7
	Shock Cardiogenic	1	3,3
	Sepsis	6	20,0
	Stroke	14	46,7
	Total	30	100
4	Length of stay hospitalization (Day)		
	1-7	12	40,0
	> 7	18	60,0
	Total	30	100

Source : Primary Data 2020

Table 1 represents that most of the respondents were aged (55-65 years) as many as 20 patients (66.7%), most of the sexes were male 17 patients (56.7%), the most medical diagnoses of stroke were 14 patients (46.7 %) and length of stay > 7 days totaled 18 patients (60.0%).

Table 2 Distribution of Oxygen Saturation in Patients on Ventilator Before and After Giving the Semi-Fowler's Position with Head Elevation 30^0

Oxygen Saturation	Mean	SD	Min- Max
Before Intervention	95,786	0,505	94,8-96,4
After Intervention	97,835	0,514	96,8-98,4

Table 2 shows from 15 patients the average oxygen saturation before giving the semi-Fowler position with a head elevation of 30^0 was 95.786, with a standard deviation of 0.505. The lowest oxygen saturation is 94.8 and the highest was 96.4. After giving the semi-Fowler position with a head elevation of 30^0, the average oxygen saturation was 97.835, the median was 97.430 and the standard deviation was 0.514. The lowest oxygen saturation was 96.8 and the highest was 98.4.

Table 3 Distribution of Oxygen Saturation in Patients on Ventilator Before and After Giving the Left Lateral Position with Head Elevation 30^0

Oxygen Saturation	Mean	SD	Min- Max
Before Intervention	95,598	0,686	94,3-96,8
After Intervention	97,897	0,392	97,2-98,5

Table 3 indicates from 15 patients the mean oxygen saturation before administration of left lateral position with head elevation of 30^0 was 95.598 and standard deviation was 0.686. The lowest oxygen saturation was 94.3 and the highest was 96.8. The average oxygen saturation after administration of the left lateral position with a head elevation of 30^0 was 97.897 with standard deviation 0.392. The lowest oxygen saturation was 97.2 and the highest was 98.5.

Table 4 Distribution of Differences in Increased Oxygen Saturation Before and After Giving the Semi-Fowler's Position with Head Elevation of 30^0 in Patients on Ventilator

Oxygen Saturation	Mean	SD	Average Ascension	T Count	95% CI	*P value*
Before Intervention	95,786	0,505	1,764	14,105	1,495-2,032	0,000
After Intervention	97,550	0,514				

Table 4 signifies that the average oxygen saturation before and after administration the Semi Fowler position with a head elevation of 30^0 were 95,786 and 97,550. There was an increase in oxygen saturation after giving the semi-Fowler position with an average increase of 1.764. The results of further analysis with the dependent T test obtained P value = 0.000 < (0.05) then Ho is rejected, this pointed that

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there is an effect of giving the semi-Fowler position with a head elevation of 30^0 to the increase in oxygen saturation.

Table 5 Distribution of Differences in Increased Oxygen Saturation Before and After Administration of Left Lateral Position with Head Elevation of 300 Patients on Ventilator

Oxygen Saturation	Mean	SD	Average Ascension	T Count	95% CI	*P value*
Before Intervention	95,598	0,686	2,299	17,426	2,016-2,582	0,000
After Intervention	97,897	0,392				

Table 5 denotes that the average oxygen saturation before and after administration the left lateral position with a head elevation of 30^0 were 95,598 and 97,897. There was an increase in oxygen saturation after administration position with an average increase of 2.299. The results of further analysis with the dependent T test obtained P value = 0.000 < (0.05) then Ho is rejected, this pointed that there is an effect of giving the left lateral position with a head elevation of 30^0 to the increase in oxygen saturation.

Discussion

1. Characteristics of Respondents
   a. Age

According to Hudak & Gallo (2011) Long life span is the single most important cause of the increasing number of critically ill patients with complicated and acute illnesses. Getting older is the more physiological and psychological changes due to the aging process. The condition changes have an impact on a person's health.

The research of Ozyurex et al (2012) described that German ICU surveillance system data, Krankenhaus Infection Surveillance System (KISS) resolved the differences in the incidence of nosocomial infections in various types of ICU wards. One of the most common types of infection in the ICU in adults was pneumonia. This was associated with the frequent admission of adult ICU patients due to disturbances in the respiratory system and requiring ventilator assistance. These results were in line with the research of Karmiza et al (2014) which states that the proportion of respondents based on age is mostly in the range of 41-65 years as many as 6 people (40%).

Based on the researcher's analysis in this study, data has been obtained that the age of the majority of respondents was between 55-65 years. At this age the patient has entered old age, where degenerative diseases have been a risk factor due to changes in body system function. Therefore, if the respondent was admitted to the ICU and had respiratory failure, they needed a ventilator to maintain their life. Getting older caused the body to lose the ability to replace damaged cells and maintain their normal structure and function, so that they were unable to repair the damage suffered.

b. Gender

According to Ratnasari (2012) the majority of respondents were male. This was related to other triggering factors that are mostly done by male such as smoking, consuming alcohol and so on. Chemicals contained in cigarettes may cause an increased concentrations of fibrinogen, hematocrit and platelet aggregation, decreased fibrinolytic activity and cerebral blood flow. This condition causes vasoconstriction, resulting in the formation of atherosclerotic plaques especially in brain blood vessels.

According to the researchers, many men were treated in the ICU (57.6%) because they had a lot of activities outside the home in accordance with their role as the head of the household. These activities may increase the risk of trauma or exposure to disease and add

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to the smoking habit which is one of the risk factors that trigger stroke. Moreover, it may lead to hypertension, arteriosclerosis, lungs cancer and others.

c. Medical diagnosis

The results of the study showed that the 30 patients on ventilators in the ICU at Dustira Hospital Cimahi, almost half (46.7%) had a medical diagnosis of stroke.

Hudak & Gallo (2011) explained that hemorrhagic stroke occurs in about 20% of stroke cases. The main cause is hypertension and vascular disease. Hemorrhagic stroke rapidly induces a brain damage function and loss of consciousness.

Purnawan (2012) clarified that the causes of intracerebral hemorrhage include hypertensive, intracerebral hemorrhage, subarachnoid hemorrhage due to rupture of a subcular aneurysm, ruptured arteriovenous malformation and trauma, cocaine and amphetamine abuse, bleeding, brain tumors, hemorrhagic infarction, and anticoagulation therapy.

These results of the study was in line with the research of Hartoyo et al. (2017) which explicated that the characteristics of respondents based on medical diagnoses in ICU patients were Hemorrhagic Stroke as many as 4 respondents (26.7%).

The researcher assumes the majority of respondents were stroke (46.7%), this reflects the main type of disease that requires the use of a ventilator in the ICU was stroke, thus requiring hemodynamic monitoring and intensive care.

d. Length of stay hospitalization

According to Mahvar et al. (2012) nurses realized that in the intensive care unit they took care of patients in critical condition, thus requiring a long treatment. Changes in position are needed to avoid complications in body systems such as decubitus ulcers, pneumonia, atrophy and others.

A study by Hardisman (2015) defined that the length of stay hospitalization of patients in the ICU varied from less than 1 day to a maximum of 34 days, with an average of 4.3 days.

Based on the grouping of the research, it was found that generally the length of stay was more than 7 days (85.2%). The researcher's analysis, the length of treatment for the respondent in the ICU depended on the medical diagnosis and medical condition of the respondent. The respondent's length of stay of more than seven days may due to the patient's condition, the patient's illness, complications, availability of assistive devices such as ventilator machines and the ability to treat patients by healthcare provider.

2. Increase in oxygen saturation before and after administration of the semi-fowler position with a head elevation of 30^0

The results of study by Moaty et al (2017) pointed the effect of the semi-Fowler's position on oxygenation and hemodynamic status in patients with head injuries exhibited that the semi-Fowler's position with an elevation of 30° had a positive impact on breathing with the result of an increase in PaO_2, SaO_2, and respiration as well as a decrease in $PaCO_2$. The research of Novarita, et al. (2016) proved that the semi-Fowler position was effective in increasing tidal volume in respiratory failure patients who were on a ventilator in the ICU of Tugurejo Hospital Semarang. Research by Meilirianta et.al (2016) found that there were differences in changes in oxygen saturation in patients with bronchial asthma between in the semi-Fowler position group and in the high fowler position group in inpatient rooms D3 and E3 at the Cibabat General Hospital Cimahi.

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The Semi-Fowler's position is the patient's sleeping position with the head and chest higher than the pelvis and legs, where the head and chest are raised at an angle of 30^0-45^0. Semi-Fowler's position adjustment aims to advance respiratory capacity, prevent aspiration, and increase patient's comfort. When the client is in this position, gravity pulls the diaphragm down, allowing for greater chest expansion and pulmonary ventilation (Kozier, 2010; Smith-Temple & Johnson, 2011).

Semi-Fowler's position makes oxygen in the lungs increase so that it relieves breathing difficulties. This position reduces the damage to the alveolar membrane due to accumulation of fluid. This may be influenced by the force of gravity so that O_2 delivery is optimal and shortness of breath may be overcome (Supadi, 2008 in Yuliana, 2017).

Researchers proves that the increase in oxygen saturation in the semi-Fowler position with elevation of the head of 30^0 occurs because in this position, the top of the lungs is far above the heart. As a result, the pressure in the lower part of the lungs is lower than in the rest of the pulmonary circulation. In theory of respiratory physiology, gases diffuse from areas of high pressure to areas of low pressure. From this theory, it can be concluded that in the semi-Fowler position the exchange and diffusion between oxygen and carbon dioxide may run more quickly and optimally. Furthermore, it can produce a maximum tidal volume which has an impact on increasing oxygen saturation.

3. Comparison of the increase in oxygen saturation in patients on a ventilator on the left lateral with a head elevation of 30^0.

A study by Mahvar *et al.* (2012) explained the effectiveness of 3 types of positions change to increase the oxygen partial pressure value (PO_2) in patients with coronary artery by-pass. This study pointed a PO_2 and oxygen saturation on left lateral had a highest value compare with supine and right lateral positions and semi fowler's positions. Karmiza et.al (2014) proves that a left lateral position with head elevation 30^0 can increase PO_2 in patients on a ventilator.

According to Ignativicius & Workman (2016) the aims regularly changing position of patients in ICU were to prioritize patients comfort, prevent pressure ulcer, reduce the occurrence of deep vein thrombosis, pulmonary embolism, atelectasis and pneumonia. Changes in position may affect the expansion of the lungs and the chest wall as well as lung volume and gas exchange. Patients treated in the ICU who were on a ventilator will experience respiratory problem and accumulation secret. In the event, there is no change in position by healthcare provider, this problem may produce infection and respiratory failure.

Based on theory by Price and Wilson (2012) describe respiratory physiology in the upright position ventilation per unit volume of the lung at the base is greater than at the apex. This happens because of at the beginning of inspiration the intrapleural pressure at the base of the lung is less negative than at the apex, with the result that the difference in intrapulmonary-intrapleural pressure at the base is smaller than at the apex due to the lungs become less stretched. On the other hand, the lungs tissue at the apex is more stretched so that the maximum lung volume percentage become larger than at the base of the lungs (Novarita, dkk., 2016).

This study has proven that both semi-Fowler and left lateral head elevation 30 degrees can improve ventilation so as to increase oxygen saturation and reduce the risk of aspiration in mechanically ventilated patients. In addition, Price and Wilson (2012) explained that the adequacy of pulmonary ventilation is determined by lung volume, airway resistance, lung compliance and the condition of the chest wall.

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Conclusion and Suggestion

The semi-Fowler and left lateral positions have helped the patient to appear more comfortable, less anxious, hemodynamically stable, the saturation increased to 98.53%. This is evidenced in both semi-Fowler and left lateral positions to increase oxygen saturation with a p-value of 0.000 (<0.005).

Nurses in the ICU can apply the results of this study so that they can support healing and minimize the incidence of further complications in patients.

This research can be developed with a wider range and can be compared with other positions, so that the best position will be obtained for patients treated in the ICU who are on a ventilator. Thus, the length of treatment will be shorter.

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