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The Effect of Prone Positioning to Increase Oxygen Saturation in Covid-19 Patients at Hermina Banyumanik Hospital

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ABSTRACT

The coronavirus disease 2019 (Covid-19) pandemic is still a problem for many countries in the world. One of the symptoms of Covid-19 patients is respiratory disorders with clinical signs of pneumonia both mild to severe which is characterized by low levels of oxygen saturation in the body. There is currently no FDA (Food and Drug Administration) approved treatment for Covid-19. In addition, an intervention that can be done to overcome the problem of ineffectiveness of breath patterns is by regulating the position in the patient. One of the supportive and rehabilitative treatments for Covid-19 patients is the prone position. This study was conducted to assess the effectiveness of prone positioning on increasing oxygen saturation in Covid-19 patients at Hermina Banyumanik Hospital. The design used in this study is quasi-experimental design and uses a nonequivalent control group design model. The number of samples in this study was 16 respondents plus 30% to 20 respondents in each group, who were moderate symptomatic Covid-19 patients from June to August 2021. This study used the wilcoxon test with the results of asymp.sig. (2-tailed) is worth 0.000 < 0.05, then it can be concluded that there is an influence of prone position on increasing oxygen saturation.
Based on these results, it can be seen that there is an effectiveness of prone position in increasing oxygen saturation in Covid-19 patients at Hermina Banyumanik Hospital

Keyword: Prone, Saturation, Oxygen, COVID-19

ABSTRAK

Pandemi coronavirus disease 2019 (Covid-19) masih menjadi masalah bagi banyak negara di dunia. Salah satu gejala pasien Covid-19 adalah gangguan pernapasan dengan tanda klinis pneumonia baik ringan hingga berat yang ditandai dengan rendahnya kadar saturasi oksigen dalam tubuh. Saat ini tidak ada pengobatan yang disetujui FDA (Food and Drug Administration) untuk Covid-19. Selain itu, intervensi yang dapat dilakukan untuk mengatasi masalah ketidakefektifan pola napas adalah dengan mengatur posisi pada pasien. Salah satu perawatan suportif dan rehabilitatif pasien Covid-19 adalah posisi tengkurap. Penelitian ini dilakukan untuk menilai efektivitas posisi tengkurap terhadap peningkatan saturasi oksigen pada pasien Covid-19 di RS Hermina Banyumanik. Desain yang digunakan dalam penelitian ini adalah desain quasi eksperimental dan menggunakan model desain nonequivalent control group design. Jumlah sampel dalam penelitian ini adalah 16 responden ditambah 30% hingga 20 responden di setiap kelompok, yang merupakan pasien Covid-19 bergejala sedang dari Juni hingga Agustus 2021. Penelitian ini menggunakan uji wilcoxon dengan hasil asymp.sig. (2-tailed) bernilai 0,000 < 0,05, maka dapat disimpulkan bahwa terdapat pengaruh posisi tengkurap terhadap peningkatan saturasi oksigen. Berdasarkan hasil tersebut, dapat diketahui bahwa terdapat efektivitas posisi tengkurap dalam meningkatkan saturasi oksigen pada pasien Covid-19 di RS Hermina Banyumanik.

Kata Kunci: *Posisi tengkurap, Saturasi, Oksigen, COVID-19*

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Introduction:

The coronavirus disease 2019 (Covid-19) pandemic is still a problem for many countries in the world. A number of countries are still trying to suppress the spread of Covid-19 caused by the SARS-CoV-2 virus. In addition to attacking the respiratory tract, the coronavirus is also said to be able to spread more widely. Based on data from the World Health Organization (WHO), there are 207,446,107 cases of Covid-19 infection (WHO, 2021). Of these, 4,365,962 people died, while those who recovered reached 185,974,336. In India, Covid-19 cases were recorded at 32,191,954 cases.

According to the Ministry of Health of the Republic of Indonesia, Covid-19 cases were recorded at 3,892,479 confirmed cases of Covid-19 (Ministry of Health, 2021). At Hermina Banyumanik Hospital, the incidence of Covid-19 cases from January to July 2021 was 427 cases. The increase in Covid-19 patients itself occurred in June 2021, namely 102 cases with symptoms of respiratory disorders. The data above illustrates that Covid-19 cases are still high and remain a serious health problem.[1,2,3]

One of the symptoms of Covid-19 patients is respiratory disorders with clinical signs of pneumonia both mild to severe. This symptom is characterized by low levels of oxygen saturation in the body, so it is very important to assess the oxygen saturation to know the next treatment. There is currently no FDA (Food and Drug Administration) approved treatment for Covid-19. In addition, an intervention that can be done to overcome the problem of ineffectiveness of breath patterns is by regulating the position in the patient. Therefore, supportive and rehabilitative care is needed to reduce symptoms and risk of death. One of the supportive and rehabilitative treatments for Covid-19 patients is the prone position.

Research conducted by Kurniasih, et al. that prone position shows an increase in oxygenation of patients with respiratory diseases related to Covid-19. The degree of severity of the disease and intubation decreased by 65.5%. For this reason, it is necessary to position prone in Covid-19 patients with pneumonia before falling into Acute Respiratory Distress Syndrome (ARDS). This study was conducted to assess the effectiveness of prone position against increasing oxygen saturation in Covid-19 patients at Hermina Banyumanik Hospital.[4]

Methods:

The design used in this study is quasi-experimental design and uses a nonequivalent control group design model. Before being given treatment, both the experimental group and the control group were given a pretest test, with the intention of knowing the condition of the group before treatment. Then after being given treatment, the experimental group and the control group were given a test, namely posttest, to find out the condition of the group after treatment. This research will use a quasi-experimental research design.

In this study, the population in question was all moderately symptomatic COVID-19 patients who were treated at Hermina Banyumanik Hospital from June to August 2021. The determination of sampling in this study used a non-probability sampling approach, with a type of purposive sampling, namely all Covid-19 patients treated at Hermina Banyumanik Hospital who met the inclusion and exclusion criteria from the study.

The free variable in this study is prone positioning and the bound variable is the oxygen saturation level in COVID-19 patients at Hermina Banyumanik Hospital. The instrument uses a cheklist by measuring the patient's oxygen saturation which is prone position and not prone position using a brand saturation device named BEREUR. The intervention carried out was the provision of prone positioning to moderately symptomatic COVID-19 patients at Hermina Banyumanik Hospital. Data collection was carried out in the Covid-19 Inpatient Room from June to August 2021.

The data analysis that will be carried out in this study is univariate and bivariate analysis. Bivariate analysis began with conducting a normality test using the Kolmogorov-Sminov and Saphiro-Wilk tests obtained the results of significance data for pre-proning and post-proning treatment and control groups were $p< 0.05$, so it was found that the distribution of data

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was abnormal. So to find out the hypothesis between the administration of prone position therapy and oxygen saturation, the Wilcoxon test was carried out. This research received approval from the research ethics committee team of Hermina Banyumanik Hospital

Results:

Characteristics of respondents by age found that, the most age in respondents was 57 years old as shown in table 1.

TABLE 1. Frequency Distribution of Respondents by Age

AGE					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	35	1	2,5	2,5	2,5
	42	9	22,5	22,5	25,0
	44	1	2,5	2,5	27,5
	48	2	5,0	5,0	32,5
	52	2	5,0	5,0	37,5
	54	4	10,0	10,0	47,5
	57	11	27,5	27,5	75,0
	69	10	25,0	25,0	100,0
	Total	**40**	**100,0**	**100,0**	

The highest gender in respondents in this study was female at 57.5% as shown in table 2.

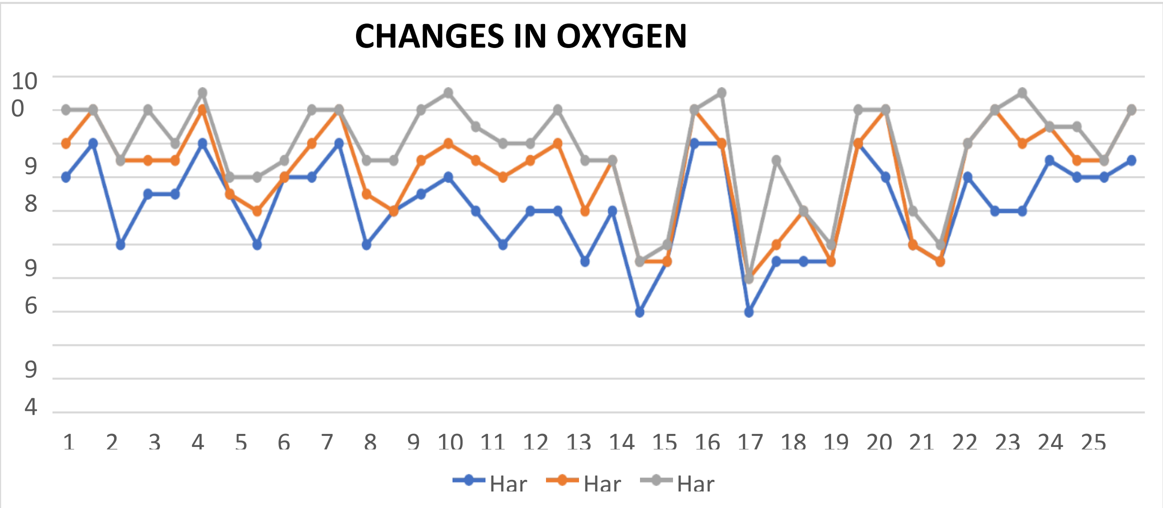
TABLE 2. Distribution of Respondents by Gender

GENDER					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	MALE	17	42,5	42,5	42,5
	FEMALE	23	57,5	57,5	100,0
	Total	**40**	**100,0**	**100,0**	

The highest oxygen saturation before being given the intervention was Sp02 92% as many as 7 people as shown in table 3.

TABLE 3. Oxygen Saturation Distribution Before Treatment Prone Position

CONTROL GROUP					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	98	2	5,0	5,0	5,0
	97	1	2,5	2,5	7,5
	96	5	12,5	12,5	20,0
	95	4	10,0	10,0	30,0
	94	6	15,0	15,0	45,0
	92	7	17,5	17,5	62,5
	90	6	15,0	15,0	77,5
	89	6	15,0	15,0	92,5
	88	3	7,5	7,5	100,0
	Total	**40**	**100,0**	**100,0**	



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The results of oxygen saturation after being given prone position treatment in the treatment group were 13 people with Sp02 99%. This is seen in table 4.

TABLE 4. Oxygen Saturation Distribution After Prone Position Treatment

TREATMENT GROUP					
		Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	99	13	32,5	32,5	32,5
	98	9	22,5	22,5	55,0
	97	8	20,0	20,0	75,0
	96	9	22,5	22,5	97,5
	95	1	2,5	2,5	100,0
	Total	**40**	**100,0**	**100,0**	

Based on the normality test, the p value result < 0.05 so that the distribution of data is said to be abnormal. So the next hypothesis test uses the wilcoxcon test. The results of the test can be seen in table 5.

TABLE 5. *Rank*

Ranks		N	Mean Rank	Sum of Ranks
CONTROL GROUP - PRE PRONING	Negative Ranks	0[a]	,00	,00
	Positive Ranks	40[b]	20,50	820,00
	Ties	0[c]		
	Total	40		
TREATMENT GROUP - POST PRONING	Negative Ranks	12[d]	12,00	144,00
	Positive Ranks	22[e]	20,50	451,00
	Ties	6[f]		
	Total	40		

a. CONTROL GROUP < PRE PRONING
b. CONTROL GROUP > PRE PRONING
c. CONTROL GROUP = PRE PRONING
d. TREATMENT GROUP < POST PRONING
e. TREATMENT GROUP > POST PRONING
f. TREATMENT GROUP = POST PRONING

Based on table 5, it is known that the pre-prone in the control group did not have a difference as evidenced by the results of negative ranks 0 and positive ranks 40. From the post prone in the treatment group, there was a difference in negative ranks of 12 and positive ranks of 22, which means an increase in the value of oxygen saturation after prone position.

TABLE 6. *Wilcoxon Test*

Test Statistics[a]	KELOMPOK KONTROL - PRE PRONING	KELOMPOK PERLAKUAN - POSTPRONING
Z	-5,524[b]	-2,730[b]
Asymp. (2-tailed)	,000	,006

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Based on table 6, the wilcoxon asymp.sig test. (2-tailed) is worth 0.000 < 0.05, then it can be concluded that the "hypothesis is accepted". This means that there is an influence of prone position on increasing oxygen saturation, so it can be concluded that there is also an effectiveness of prone position in increasing oxygen saturation at Hermina Banyumanik Hospital.

Discussion:

This study aims to assess the effectiveness of prone position on increasing oxygen saturation at Hermina Banyumanik Hospital. From the results of the study, it was proven that there was an increase in oxygen saturation after prone position was carried out. Corona virus is a set of viruses that infect the respiratory system. Dyspnea is the most common symptom that arises in severe diseases and is accompanied by hypoxemia. The progressivity of respiratory failure develops immediately after the onset of dyspnea and hypoxemia. When severe pneumonia or ARDS alveoli in the lungs are inflamed and blocked. This condition causes the patient to have difficulty breathing because the lungs fill with fluid, become stiff and difficult to expand and deflate, so the patient needs immediate help.

Rehabilitative supportive care in COVID-19 patients with severe symptoms includes breathing exercises, physical modalities in the form of Neuromuscular Electrical Stimulation (NMES) and positioning, one of which is prone positioning to increase oxygen saturation.[4]

In general, hypoxemia in pulmonary diseases causes hyperventilation which results in large amounts of CO2 escaping. Although some patients do not show significant hypoxemia at an early stage, in the event of respiratory alkalosis then the patient enters in a period of hyperventilation compensation that will soon worsen. Most COVID-19 cases experience a period of hyperventilation compensation and respiratory alkalosis before decompensation occurs which then becomes respiratory failure. Patients with respiratory alkalosis significantly increase the risk of severe symptoms of COVID-19 and even death. ARDS in COVID-19 can occur due to cytokine storm or cytokine release syndrome (CRS). Activation of various immune systems; such as macrophages, antigen-presenting cells, T cells and B cells; causes the release of pro-inflammatory factors in large quantities; including cytokines, chemokines, and interleukin especially interleukin-6. This causes an increase in vascular permeability so that a large number of fluid bags collapse and blood cells enter the alveloli resulting in shortness of breath and even respiratory failure. [4]

The most common comorbidities in COVID-19 include hypertension, obesity and diabetes. Obesity is thought to be one of the most frequent causes of COVID-19 deaths. Adipose tissue induces low-degree chronic inflammation, characterized by an increase in levels of pro-inflammatory cytokines and a decrease in anti-inflammatory cytokines (adiponectin and IL-10). This leads to T cell fatigue that interferes with the response and ability to irradiate the virus from the host. Another crucial aspect of obesity is the lack of activity which can also interfere with immune cell activation. SARS-CoV-2 binds to ACE2 receptors abundantly found in the alveolus and also in adipose tissue. The virus causes an increase in lymphocyte apoptosis and disrupts lymphocyte function resulting in a storm of fulminant cytokines characterized by levels of IL-6, IL-2, IL-7, and TNFa overcirculation. The effects of obesity on COVID-19 are associated with other comorbidities such as diabetes, hypertension, and cardiovascular disease. [8]

ARDS in COVID-19 may worsen if not treated immediately. The main purpose of handling is to increase oxygenation by providing oxygen therapy and prone position. Positioning the patient in prone causes more regular alveolus configuration and perfusion, reducing ventilation/perfusion discrepancies (V/Q missmatch), hypoxemia, and shunting. Through several mechanisms, namely transpulmonary pressure (TPP) gradient, reducing lung compression, and shape matching. Prone position reduces the pleural pressure gradient between the dependent and non-dependent pulmonary regions of the effects of gravity and the conformity of the pulmonary conformation form with the chest cavity. This can lead to pulmonary aeration and a more homogeneous pressure distribution thereby increasing the recruitment of dorsal lung units. The combination of prone position with the use of HFNC or NIV/ CPAP can help reduce some of these detrimental effects by reducing regional hyperinflation. Prone position can also increase secretion clearance. Dorsal to ventral orientation of the main airway results in more efficient secretion drainage. [9]

The prone position can increase oxygenation with the average SpO2 achievement increasing from 94% to 98%. In addition, in his research, it was also found that there was an increase in PaO2 / FIO2 which was previously 89 to 165 mmHg, this condition was also supported by research conducted by Jouffroy, et al (2020). The same was revealed by Solverson, et al (2020) that the prone position increased SpO2 from 91% to 98%.[4,8]

Research by Jouffroy, et al (2020) and Jayakumar, et al (2021) stated that the prone position was carried out with a maximum duration of 6 hours. In contrast to tonelli's study, et al (2020) prone position was carried out for at least 3 hours, while solverson's study, et al (2020) stated that patients were on average able to tolerate prone positions for 75 minutes. Research caputo, et al (2020) duration of prone position administration in patients varies depending on the patient's ability to tolerate prone position.[9]

The assessment of the success of the prone position on oxygenation can be judged from several indicators, namely the increase in SpO2 , the improvement of the results of blood gas analysis, especially partial oxygen pressure and arterial blood oxygen saturation which significantly occurs in the first 3 days. In the Spanish study, 80% of ARDS patients experienced an increase in PaO2 after 30 minutes of prone position, while a meta-analysis study on 1,372 patients showed a significant increase in P:F ratio. Evaluation of the success of the combination of HFNC and prone position should also be assessed every 1–2 hours using the ROX index. The use of HFNC is considered successful and does not require invasive ventilation if the ROX index is ³4.88 which is rated at the 2nd, 6th, and 12th hours. Conversely, if <3.85, it is estimated that the need for intubation will increase. [8]

Conclusions:

Covid-19 patients provide a spectrum of symptoms that vary from asymptomatic, mild symptoms, pneumonia, severe pneumonia, ARDS, to sepsis shock. The use of prone positions in moderate to severe respiratory disorders experienced by COVID-19 patients is considered safe enough to do. The level of patient tolerance to the duration of the prone position is different so that during the intervention it is necessary to continuously monitor the patient's condition.

Prone position for increased oxygenation, preventing the severity of the disease, preventing ICU intubation/treatment and mechanical ventilation. Positioning requires low costs, less resource utilization, and an easy-to-implement strategy. The prone position is the right choice for patients suffering from COVID-19-related ARDS. The majority of patients showed improved oxygenation and breathing.

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