The Influence of Progressive Muscle Relaxation on Oxygen Saturation to Patient With Chronic Obstructive Pulmonary Disease in IRNA C RSUP Sanglah Denpasar

Ns. Ni Putu Ari Widiastuti, S.Kep, I Ketut Suardana, S.Kp.,M.Kes[2],
Ns.I.G.A Putu Triyani, S.Kep., M.Fis[3]

Ariwi199052@gmail.com
1. Nursing Departement, Sekolah Tinggi Ilmu Kesehatan Wira Medika Bali, Bali, Indonesia
2. Nursing Departement, Politeknik Kesehatan Kemenkes Denpasar,Bali, Indonesia
3. Nursing Departement, Sekolah Tinggi Ilmu Kesehatan Wira Medika Bali, Bali, Indonesia

Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a progressive lung disease caused by abnormal inflammation in lung tissue. Patient with COPD feel dypsnea and uncomfortable in activity that decreasing functional capability and the quality of life. Progressive muscle relaxation is one of non pharmacology technique to patient with COPD. It can repair pulmonary ventilation by decreasing chronic constriction of the respiratory muscle, increasing the diaphragm muscle and metabolism of energy.

Methods: The objective of this study is to analyze the influence of progressive muscle relaxation on oxygen saturation to patient with COPD in IRNA C RSUP Sanglah Denpasar. This study using pre-experimental one group pretest and posttest design. The sampling technique that used is non probability sampling of consecutive sampling with 21 samples.

Results: Paired t-test result p values obtained value of 0,002 with significant level α=0,05. It can conclude that progressive muscle relaxation influence on oxygen saturation to patient with COPD in IRNA C RSUP Sanglah Denpasar.

Conclusions: It is also suggest to give progressive muscle relaxation in hospital two times a day.

Keywords: progressive muscle relaxation, oxygen saturation, COPD

1. Introduction

Chronic obstructive pulmonary disease (COPD) is a chronic lung disease characterized by airflow obstruction that is not completely reversible (Minister of Health, 2008). Airflow obstruction occurs progressively and is associated with an abnormal inflammatory response in lung tissue to exposure to harmful particles or gases. According to Price and Wilson (2005), COPD is a term used for a group of long-lasting lung diseases with the main pathophysiology of increased resistance to air flow. The lung diseases classified as COPD include chronic bronchitis and emphysema.

Impaired lung function in COPD patients occurs due to changes in the ventilation and perfusion ratio (V/Q). Decreased ventilation occurs due to respiratory tract resistance, especially changes in the small respiratory tract. The small respiratory tract, which lacks cartilaginous rings, is kept open by a transmular gradient that stretches the alveoli (Sherwood, 2001). During inspiration, expansion of the chest cavity expands the respiratory tract beyond expiratory size and respiratory tract resistance decreases. On the other hand, when exhaling, the resistance of the respiratory tract will become greater, making exhalation more difficult and increasing the volume of air trapped (air tapping). Air tapping for a long time causes the diaphragm to flatten, contractions are less effective and its function as the main respiratory muscle is reduced in lung ventilation. Compensation by the body includes increasing the use of additional inspiratory muscles and increasing the work of the intercostal muscles resulting in a decrease in the role of the diaphragm, increased respiratory frequency, shortness of breath and uncoordinated breathing patterns. Compensatory conditions that cause chronic constriction of the respiratory muscles will increase the need for energy metabolism (Guyton, 1990).

An increase in respiratory frequency causes hyperventilation to expel more carbon dioxide and increase PaO2 (Price, 2005). However, due to chronic constriction of the respiratory muscles, cells produce more carbon dioxide and PaO2 decreases due to obstruction. PaO2 values that decrease in COPD patients will cause hypoxemia (Guyton, 1990).

The low PaO2 value in COPD patients in the blood causes a low percentage of oxygen bound to hemoglobin in peripheral arteries, which is called oxygen saturation (Soemantri in Suyono et al., 2001). The condition of decreasing oxygen saturation is called desaturation. Desaturation in COPD patients can be monitored more effectively using pulse oximetry (Smeltzer and Bare, 2001). Oxygen saturation can provide a more effective picture of tissue oxygenation than PaO2 because to meet tissue oxygenation needs, blood will bind to hemoglobin around 98.5% and only 1.5% will bind to plasma (Sherwood, 2001).

According to GOLD (2010) in Ikawati (2011), management of COPD consists of four main components, namely: disease monitoring and assessment, reduction of risk factors, management of stable COPD and management of acute exacerbations. According to Ikawati (2011), there is no combination of drugs that can treat decreased lung function in COPD patients. Therefore, supportive and palliative treatment is needed to improve quality of life with pulmonary rehabilitation. Comprehensive pulmonary rehabilitation consists of physical exercises (breathing exercises, chest physiotherapy and postural drainage), reconditioning exercises (walking, cycling and running) and psychosocial support (Ikawati, 2011). Meanwhile, relaxation exercises are still rarely done in COPD patients (Sukartini, 2008). One of the relaxation exercises that can be given to COPD patients is progressive muscle relaxation.

Progressive muscle relaxation is a combination of breathing exercise (diaphragm breathing exercises and purced lips breathing) with a series of relaxation of the body's muscles (Sukartini, 2008). Providing progressive muscle relaxation can reduce anxiety and shortness of breath in COPD patients (Gift et al, 1997). Progressive contraction and relaxation of a group of body muscles helps reduce the need for energy and oxygen metabolism, thereby training COPD patients not to use additional inspiratory muscles. Diaphragmatic breathing exercises in COPD patients are carried out to reduce respiratory frequency, increase alveolar ventilation and increase exhaled air (Smeltzer and Bare, 2001). In addition, diaphragmatic breathing exercises can reduce constriction of the respiratory muscles, maximize the use of the diaphragm muscles and increase oxygen uptake (Sukartini, 2008). Pursed lips breathing can prevent bronchiole collapse so that expiratory flow is more optimal.

Data obtained from the World Health Organization (WHO) shows that in 1990, COPD was the sixth cause of death in the world and in 2002 it ranked third after cardiovascular disease and cancer. In the United States, it is reported that more than 30 million people suffer from COPD such as emphysema, asthma and chronic bronchitis and it costs no less than 61.5 billion dollars every year. WHO estimates that in 2020 the prevalence of COPD will continue to increase from sixth to third in mortality. In addition, worldwide it is reported that there are three million deaths due to COPD every year (Minister of Health, 2008).

Based on the results of SUSENAS (National Socio-Economic Survey) in 2001, it was reported that 54.5% of the male population and 1.2% of women were smokers. Of the percentage of smokers, 92.0% stated that they had the habit of smoking at home when with other family members (Minister of Health, 2008). The number of smokers at risk of suffering from COPD and lung cancer ranges from 20-25%. Apart from the increasing number of smokers, air pollution also increases the risk of chronic obstructive pulmonary disease (COPD).

In Indonesia, there is no accurate data on the incidence of COPD. In 1997, there were 124 COPD sufferers who were inpatients at Friendship Hospital, while 1,837 people were outpatients. At Dr. Hospital Moewardi Surakarta in 2003 found 444 COPD sufferers were inpatients and 2,368 people were outpatients. Meanwhile, data obtained at Sanglah General Hospital, Denpasar, inpatient COPD patients in 2006 amounted to 284 people, in 2007 there were 287 people, in 2008 there were 289 people with an increase every year.

Based on a preliminary study conducted at IRNA C Sanglah Hospital Denpasar, namely from monthly and annual reports, it shows that patients with COPD are the fifth of the top ten diseases. On average, 22 COPD patients are treated at IRNA C every month. COPD patients treated at IRNA C complain of shortness of breath and coughing. The patient also looks thin and weak. Apart from that, in IRNA C more pharmacological actions are carried out than non-pharmacological actions. One non-pharmacological action that has never been carried out at IRNA C in COPD patients is progressive muscle relaxation.

"Based on the description of the problem above, researchers are interested in conducting research on the effect of progressive muscle relaxation on oxygen saturation in COPD patients at IRNA C Sanglah Hospital, Denpasar."

2. Methods

The type of research used was pre-experimental with one group pretest-posttest design (Sugiyono, 2010). In the one group pretest-posttest design, a pre-test is carried out before progressive muscle relaxation is carried out and then a post-test is carried out, namely after progressive muscle relaxation is carried out. The subject approach used in this research is the time series approach. The time series or longitudinal approach is that the researcher observes the dependent variable first, then the subject is observed over a certain period of time to see the influence of the independent variable on the dependent variable (Sastroasmoro & Ismael, 2010).

Sample in this study was 21 COPD patients treated at IRNA C from April to May 2012 according to the data collection period of 6 weeks. The requirements that must be met are in accordance with the inclusion criteria: COPD patients who are willing to become respondents, COPD patients who have not received their next bronchodilator (one hour before the next bronchodilator), Cooperative COPD patients. The exclusion criteria in this study are:COPD patients accompanied by anemia (hemoglobin value <10 mg/dl), COPD patients who experience shock, cardiac arrest, excessive vasoconstriction, COPD patients who are given intravenous drugs/dyes (methylene blue, indigo, carmine), COPD patients who are unwilling to continue / stop doing progressive muscle relaxation.

The place used in this research was Sanglah General Hospital, Denpasar. The research location is at IRNA C, namely Angsoka I and Angsoka II Rooms at Sanglah Hospital, Denpasar. This research was carried out from April 2012 to May 2012

3. Results

a. Research sites

Sanglah Denpasar Central General Hospital is a type A educational hospital located in the center of Denpasar city, Bali Province. This hospital is also a referral center hospital for the regions of Bali, West Nusa Tenggara, East Nusa Tenggara and other eastern regions of Indonesia. In carrying out services, Sanglah Central General Hospital is headed by a Main Director who is assisted by 4 (four) directors, namely the Medical and Nursing Director, HR and Education Director, Finance Director, and General and Operations Director who are under and responsible for President director.

Efforts to provide quality services are carried out by grouping patients based on their needs and type of disease, one of which is Inpatient Installation C (IRNA C). IRNA C is one of the units developed in the fields of world standard patient service, education for doctors, nurses, pharmacy, nutrition as well as research and innovation in accordance with the vision of RSUP Sanglah, namely to become a world class inpatient installation to create a healthy, independent and just society.

Inpatient Installation C (IRNA C) is a special class III treatment room for inpatient surgery, ENT, genital skin and internal medicine cases. Inpatient installation C has a bed capacity of 165 beds with five rooms, namely Angsoka I, Angsoka II, Angsoka III, Gadung and Cambodia. The number of staff at IRNA C is 121 people, 92 nursing staff, 5 billing staff and 6 cleaning service staff.

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Angsoka Room I is a treatment room for inpatient surgery (orthopedics and urology) and cardiology cases. Meanwhile, the Angsoka II room is a treatment room for inpatient cases of non-tropical internal diseases. The Angsoka I and Angsoka II rooms consist of 8 rooms with a capacity of 6 beds in each room. The staff in the Angsoka I room is 37 people, 25 nursing staff, 1 billing staff and 6 cleaning service staff. Meanwhile, the staff at Angsoka II is 29 people, with details of 22 nursing staff, 1 billing staff and 6 cleaning service staff.

b. Characteristics of Research Subjects

The subjects of this research were COPD patients undergoing inpatient treatment in Angsoka I and II rooms who were cooperative and willing to be respondents. After selecting the sample according to the research criteria, 21 respondents were obtained. The characteristics of respondents based on age and gender are as follows:

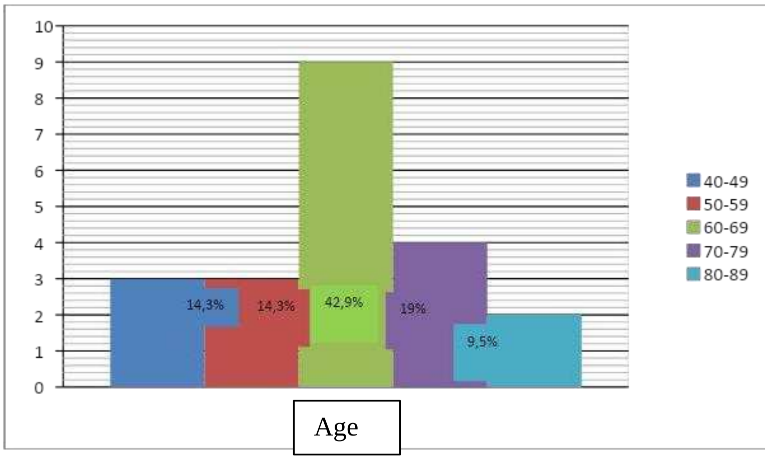

Table 1 : The age characteristics of the research subjects were that the largest age range was 60-69 years, namely 9 people (42.9%).

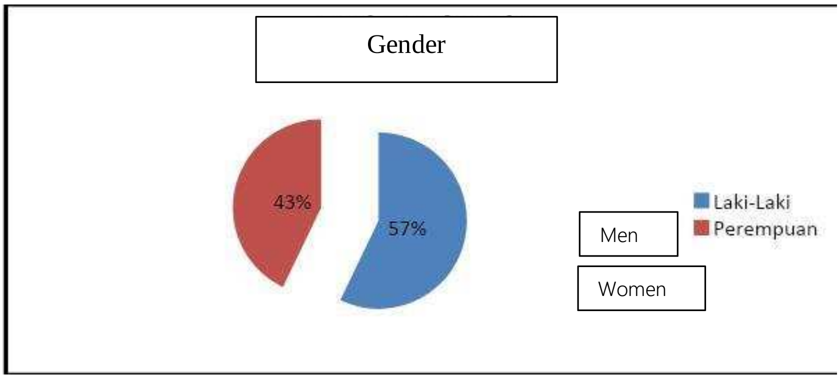

Table 2 : The research subjects with the largest gender were 12 men or 57.1% and 9 women or 42.9%.

c. Observation Results of Research Objects According to Research Variables

Oxygen Saturation (SaO2)	Frekuensi	Presentase (%)
Normal (≥90 %)	9	42,9
Abnormal (<90%)	12	57,1
Total	21	100

Table 3: The oxygen saturation value before progressive muscle relaxation was given was mostly in the abnormal range (SaO2<90%) for 12 people (57.1%)

Mean	88,47
Median	88
Minimum	82
Maximum	94
Standard Deviation	2,99564

Table 4 : Statistical Analysis Before Proggresive Muscle Relaxation

Results of statistical analysis using a computer program on oxygen saturation values before administering progressive muscle relaxation. The central tendency of the data, namely, the average value (mean) of oxygen saturation before administering progressive muscle relaxation was 88.47% and the middle value (median) was 88%. Meanwhile, for variability or dispersion, the smallest value of oxygen saturation was 85%, the largest value of oxygen saturation was 94% and the standard deviation was 2.99564

Oxygen Saturation (SaO2)		
	Frekuensi	Presentase (%)
Normal (≥90 %)	11	52,3
Abnormal (<90%)	10	47,6
Total	21	100

Table 5 : The results of identifying the oxygen saturation values of 21 respondents before being given progressive muscle relaxation were mostly in the normal range (≥90%) with a frequency of 12 people (52.3%).

Mean	89,33
Median	90
Minimum	82
Maksimum	96
Standard Deviation	3,42540

Table 6 : Statistical Analysis After progressive Muscle Relaxation

Central tendency values include the average value of oxygen saturation before giving progressive muscle relaxation of 89.33% and the average value of oxygen saturation of 90%. Variability/dispersion of the minimum value of oxygen saturation is 82%, the maximum value of oxygen saturation is 96% and the standard deviation is 3.42540

Before testing the research hypothesis, the data normality test was first carried out using the Shapiro Wilk test. The results of the normality test can be seen in Appendix 8. The calculation results show that the significance value before administering progressive muscle relaxation is 0.555 and after administering progressive muscle relaxation is 0.928. Both are greater than the error rate (α=0.05) so it can be concluded that the data is normally distributed.

The results of the complete analysis of differences in oxygen saturation values before and after progressive muscle relaxation, below is a brief analysis table of differences in oxygen saturation values:

Oxygen Saturation (SaO2)	Mean	Std. dev.	Df	P value
Before	88.4762	2.99364	20	0.002
After	89.3333	3.42250		

Table 7: Paired T-test test results for differences in oxygen saturation values before and after giving progressive muscle relaxation

Difference in mean and standard deviation of oxygen saturation values before and after giving progressive muscle relaxation. Before administration, the average SaO2 was 88.47% with a standard deviation of 2.99364. After administering progressive muscle relaxation, the average SaO2 was 89.33% with a standard deviation of 3.42250. Based on the results of statistical analysis tests using paired t-test with df=20, a p value of 0.002 was obtained.

4. Discussion

The conditions for being able to carry out analysis tests using the paired t-test are that the oxygen saturation data before and after administering progressive muscle relaxation is normally distributed. After testing the normality of the data using the Shapiro-Wilk test, it was concluded that the data was normally distributed. The results of statistical analysis, namely hypothesis testing with paired difference tests with the Paired-t test, show a significance value of 0.002. The significance value before and after progressive muscle relaxation p value (0.002) is smaller than the error level (α= 0.05) so that Ho is rejected and there is an influence of progressive muscle relaxation on oxygen saturation. The difference in oxygen saturation before and after is caused by progressive muscle relaxation which can increase ATP production, increase the strength of the respiratory muscles, reduce the use of respiratory muscles and improve lung ventilation function.

Progressive muscle relaxation which consists of a cycle of contraction, relaxation of the body's muscles and breathing exercise (diaphragmatic breathing exercises and pursed lips breathing). The cycle of contraction and relaxation of a group of body muscles optimizes the regulation of blood flow or vascularization (Choirault et al, 1999). Although the exact mechanism of action is still unclear, it is thought to be related to changes in sympathetic nervous system activity including slowing of blood flow, decreased blood pressure and decreased pressure on the musculoskeletal system as well as changes in neuroendocrine function (Cooke, 2011). Slowing blood flow causes vascularization to cells and tissues to become more adequate. Adequate vascularization improves the distribution of nutrients and oxygen so that regeneration of ATP formation becomes better. Therefore, when the body muscles contract and relax progressively, there will be a decrease in the constriction of the main respiratory muscles and

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additional respiratory muscles and subsequently reduce energy metabolism. Meanwhile, during breathing exercise, the diaphragm muscles and abdominal muscles consisting of the rectus abdominalis transversus, internal abdominalis and external oblique muscles will be actively contracted to increase expiratory air flow (Sherwood, 2001).

During diaphragmatic breathing exercises, inspiration is done slowly and deeply. The muscles between the external ribs will contract causing the ribs to lift to enlarge the thoracic cavity to the front and back and to the sides so that intra-alveolar pressure decreases and air flows into the alveoli from the atmosphere. When exhaling, the abdominal muscles contract, increasing intra-abdominal pressure and causing an upward force on the diaphragm. Simultaneously with expiration during diaphragmatic breathing exercises, pursed lips breathing can occur (Sukartini, 2008). Pursed lips breathing can increase pressure in the oral cavity which is transmitted to the bronchi, thereby preventing air tapping and collapse of the bronchioles during expiration. Furthermore, the vertical dimension of the thoracic cavity will decrease further, contraction of the muscles between the external ribs reduces the size from front to back and side to side by flattening the ribs thereby increasing the volume of air exhaled. In addition, contraction and relaxation of a group of body muscles progressively helps reduce the need for energy and oxygen metabolism, thus training COPD patients not to use additional inspiratory muscles, namely the strenocleidomastoid and scalenus, then rapid and ineffective breathing will be reduced.

Based on the pre-test and post-test results, researchers can analyze that the combination of the three components of progressive muscle relaxation can reduce respiratory tract resistance, thereby reducing functional residual capacity and increasing ventilation in COPD patients. Adequate ventilation will further increase oxygen diffusion in the lungs. Adequate ventilation also stimulates an increase in lung elasticity (recoil) so that the PaO2 value of oxygen binds to hemoglobin in the tissue.

5. Conclusion

The average oxygen saturation value before administering progressive muscle relaxation was 88.47%. The average oxygen saturation value after giving progressive muscle relaxation was 89.33%. The effect of progressive muscle relaxation on oxygen saturation was analyzed using a paired t-test, it was found that the p value before and after progressive muscle relaxation was 0.002, which was smaller than the error level (α=0.05), so it could be concluded that there was an effect of progressive muscle relaxation on oxygen saturation. in COPD patients at IRNA C Sanglah Hospital Denpasar.

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