The Effectiveness of Breathing Relaxation with Balloon Blowing Technique toward Physiological Changes of COPD Patients

1Tunik, 2Elsye Maria Rosa, 3Azizah Khoiriyati
1 Master of Nursing Program, Universitas Muhammadiyah Yogyakarta
2 Master of Hospital Administration, Universitas Muhammadiyah Yogyakarta
3 Master of Nursing, Universitas Muhammadiyah Yogyakarta
E-mail: azizahkhoiriyati@yahoo.com

ABSTRACT
In Indonesia, COPD ranked as the 5th highest burden of disease. Physiology is one of the problems which statistically experienced by the patients of COPD and decrease their quality of life. COPD patients’ quality of life could be increased with nonpharmacological therapy such as breathing relaxation. Breathing Relaxation with balloon-blowing technique is one of the best breathing exercises to regain the function of lungs. The objective of this thesis was to measure the effectiveness of breathing relaxation with balloon-blowing technique toward physiological changes of COPD patients by measuring blood pressure, pulse frequency, and respiratory rate. The research design used in this thesis was quasi-experimental with pre post design. The sample of the thesis was thirty-six (36) respondents of COPD patients of Flamboyan room in dr. Soedomo hospital. The sampling technique used in this research was consecutive-sampling technique. It was consisted of a group of intervention. The intervention was breathing relaxation which is blowing balloon twice per day with each section consisted of 3 sets of balloon blowing exercise. In each set, patients were asked to blow the balloon 3 times until the balloon was inflated and followed by 1 minute rest before continuing to the next set. Pre-test and post-test were used to collect the data of the research on the third and seventh day. The result were tested using Repeated ANOVA test. The result of statistical analysis showed the p value < 0.05 at the pulse and respiration rate on the third day, and p value <0.05 at all variables on the seventh day. This shows that balloon blowing intervention produced significant positive changes in physiological variables after 7 days of intervention. Relaxation technique by blowing a balloon could help intercostal muscle to elevate diaphragm and rib cage. Physiological responses (blood pressure, pulse rate, and respiratory rate) have changed significantly with balloon blowing for 7 days. Therefore, for future studies need to be conducted with control group, measuring the balloon resistance accurately.

Keywords: Balloon-blowing technique, Anxiety, COPD

I. INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a disease characterized by a limitation of airflow which cannot be fully recovered, progressive, and is associated with an abnormal response of pulmonary inflammation to harmful particles or gases that cause respiratory tract narrowing, mucous hypersecretion, and changes in the pulmonary vascular system (Brunner & Suddarth [2]). COPD patient will experience significant pulmonary function disturbance because of the inflammation and pulmonary structural resulting in weakness, decreased immunity, imbalances in the body, short breath, and hypoxemia. Patients also show psychosocial problems such as depression and anxiety, leading to decreased quality of life (Causey, R [3]; Vestbo, J et al. [15]).

The main cause of COPD is tobacco-smoking and others supporting factors such as genetic, lung development, and environmental factors (Decramer, M. [6]). Other factors that cause COPD are pollution exposure, chemical exposure, wood, animal waste-based fertilizer, coal, burning processes, electric stoves. Evidence shows that pollutant from biomass used in cooking and sewing is a significant risk factor for chronic pulmonary problems (Vestbo, J et al, [15]).

Clinically, COPD patient would experience depression and have at least two-fold risk for anxiety disorders. Anxiety in COPD patient is associated with increased risk of exacerbations, worsening health status related to patients’ quality of life, and deterioration of patient’s condition that needs hospitalization (Volvato et al. [16]). Other problems experienced by COPD patient are unstable emotion, inadequate coping strategy, feeling helpless, feeling powerless, feeling restricted, social isolation, and difficulty to socialize with other people (Volvato et al. [16]). The prevalence of anxiety among COPD patients is 10-50%, while the prevalence of depression reached 12-50%; one out of three COPD patient will experience anxiety disorders (Cleland, J A., [4]).

In 2020, WHO estimated that the mortality rate caused by COPD will be one of the biggest health issues and will cause 8.4 million people to die per year. In Indonesia, COPD ranked as the 5th highest burden of disease. From preliminary studies done in RSU dr. Soedomo Trenggalek, it could be seen that Flamboyan room (room for pulmonary disease) treated on average 120-160 COPD patients per year. Interview from 2 patients obtained the information that both are active smoker, have breathing difficulty, and productive cough.
Those symptoms will lead to physiological changes in COPD patient.

COPD patients’ quality of life could be increased with nonpharmacological therapy such as breathing exercise, breathing relaxation atau deep breathing (Bilo et al, [1]; Volvato et al, [16]). Breathing relaxation could improve lung functions and acts as a psychological therapy to reduce depression and anxiety. (Volvato et al, [16]). Smeltzer & Bare (2002) noted that the purpose of breathing relaxation is to increase alveolar ventilation, maintain gas exchange, prevent pulmonary atelectasis, increase cough efficiency, reduces both physical and emotional stress by decreasing pain and anxiety. Breathing exercise consists of many techniques, one of them is balloon blowing. Relaxation technique by blowing a balloon could help intercostal muscle to elevate diaphragm and rib cage. It could increase oxygen absorption, exchange substances that remain in the lungs and force carbon dioxide out of the lungs. Balloon blowing is very effective to help lungs expansion so it could supply more oxygen and release carbon dioxide trapped in the lungs of COPD patients. Many researches about the effect of balloon blowing to smoker conclude that blowing balloon routinely could improve pulmonary function by increasing peak expiration flow in a smoker with respiratory disturbance (Kim, J.S. [9]; Raju S., [12]).

Based on explanation above, a research is needed to understand the effect of breathing relaxation using balloon blowing technique towards physiological changes that include blood pressure, pulse frequency, and respiration frequency in COPD patients in RSUD Dr. Soedomo Trenggalek.

II. METHODS

This research is a quasi-experimental study using pre-post test design. The population in this research is COPD patients treated in the Flamboyan room of RSUD dr. Soedomo Trenggalek that was chosen by consecutive sampling method. The intervention was breathing relaxation which is blowing balloon twice per day in the morning and evening, with each section consisted of 3 sets of balloon blowing exercise. In each set, patients were asked to blow the balloon 3 times until the balloon was inflated and followed by 1 minute rest before continuing to the next set. Before blowing the balloon, patients took a deep breath for 3-4 seconds, hold it for 2-3 seconds and then blew the balloon for 5-8 seconds. This intervention was done for 1 week. The instruments used are fingertip oxymetry to measure pulse rate, sphygmomanometer to measure blood pressure and a watch to measure respiratory rate. The data was taken before and after the intervention in the third day and seventh day. The data collected was then tested for normality with Shapiro-Wilk, and the result was normal distribution for all variables. Afterwards, the data was analysed using repeated-measured ANOVA statistic test.

III. RESULT

A. Univariate analysis of maximum blood pressure, pulse frequency, respiration frequency, before and after intervention for 3 days and 7 days

Figure 1 and 2 is the maximum blood pressure, pulse frequency, and respiration frequency before and after balloon blowing intervention in the third and seventh day.

From figure 1 and 2, it could be seen that there was physiological changes. The systolic blood pressure before intervention was 190 mmHg, but after 3 days of intervention, the patient’s maximum systolic blood pressure was 150 mmHg, and after 7 days became 140 mmHg. Maximum pulse frequency before breathing relaxation was 125 x/minutes, but after 3 days of intervention, the maximum pulse rate decreased to 106 x/minutes, and after 7 days became 96 x/minutes. Respondents’ maximum respiratory rate before intervention was 29 x/minutes and after 3 days of intervention, the maximum respiratory rate was 26 x/minutes, and after 7 days was further reduced to 96x/minutes.
B. Univariate analysis of physiological changes (blood pressure, pulse rate, and respiratory rate), before and after intervention for 3 and 7 days.

Table 1. Means of physiological changes (blood pressure, pulse rate, and respiratory rate), before and after intervention in COPD patients in RSUD Dr. Soedomo Trenggalek

<table>
<thead>
<tr>
<th>Physiological Change</th>
<th>Pre</th>
<th>Post day 3</th>
<th>Post day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>124±10.2</td>
<td>129±10.9</td>
<td>124±9.8</td>
</tr>
<tr>
<td>Pulse rate</td>
<td>91.3±1.3</td>
<td>84.6±1.3</td>
<td>81.1±0.9</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>25.8±1.8</td>
<td>22.4±1.8</td>
<td>21.5±1.4</td>
</tr>
</tbody>
</table>

Source: primary data 2016-2017

The result on Table 1 shows that the mean of respondent’s blood pressure before intervention was 134 mmHg, after 3 days of intervention it was reduced to 129.2 mmHg and after 7 days of intervention it was reduced to 124.3 mmHg. The average pulse rate before intervention was 91.3, after 3 days of intervention it was reduced to 84.6 and after 7 days of intervention it was reduced to 81.1 mmHg. The average respiratory rate before intervention was 25.8, after 3 days of intervention it was reduced to 22.4 and after 7 days of intervention it was reduced to 21.5.

C. Bivariate analysis of the influence of balloon blowing intervention to physiological changes (blood pressure, pulse rate, and respiratory rate) of the respondents after intervention on day 3 and day 7

The explanation below is the result of analysis using repeated-measured ANOVA test to anxiety (blood pressure, pulse frequency, and respiration frequency) after intervention with balloon blowing for 3 days and 7 days.

Table 2. The influence intervention to physiological changes (blood pressure, pulse rate, and Respiratory rate) after breathing relaxation with balloon blowing technique for 3 days and 7 days on COPD patients in RSUD Dr. Soedomo Trenggalek

<table>
<thead>
<tr>
<th>Anxiety</th>
<th>Day 1 to Day 3</th>
<th>Day 1 to Day 7</th>
<th>Day 3 to Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>Mean±SD</td>
<td>Pr [value]</td>
<td>Mean±SD</td>
</tr>
<tr>
<td>Pulse rate</td>
<td>91.3±12.3</td>
<td>0.002</td>
<td>84.6±7.7</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>25.8±1.8</td>
<td>0.000</td>
<td>22.4±1.8</td>
</tr>
</tbody>
</table>

Source: Primary Data 2016-2017

From Table 2, it could be seen that almost all changes were significant (p < 0.05). Therefore there was significant differences between the parameters of physiological changes (blood pressure, pulse rate, and respiratory rate) in the patients before and after intervention with breathing relaxation using balloon blowing technique in RSUD Dr. Soedomo Trenggalek. In the result, there were only one insignificant result (p > 0.05), that is the blood pressure measurement at the first 3 days. However, after day 7, there was a significant change, with a p value of <0.05. This result shows that there was a significant impact from the intervention towards physiological changes variables (blood pressure, pulse rate, and respiratory rate).

IV. DISCUSSION

The result shows that there were significant physiological changes among COPD patient before and after intervention with breathing relaxation using balloon blowing technique for 7 days. The statistical analysis showed that p value reached < 0.05 in almost every variables of physiological changes which consist of blood pressure, pulse rate, and respiratory rate.

Non-pharmacologic intervention/non-drug treatment is a main therapy for patients with chronic anxiety and depression who need an effective intervention to decrease the physiological response in COPD patients. One of the psychological interventions that used in the study was breathing exercise/breathing relaxation. Breathing relaxation based was found to reduce physiological response in COPD patients, hence improving patient’s health status and quality of life.

Valenza et al. [14] did a study on the management of COPD patients with exacerbation and post-exacerbation; the aim of the research was to decrease or control anxiety and depression in patients with COPD exacerbation and treated in the hospital. The variables used by researcher were degree of shortness of breath, anxiety, depression and quality of life of the patients. The intervention done was controlled breathing program consisting of relaxation exercise, pursed lips breathing, active respiration. Relaxation exercise was done to decrease respiratory rate and increase tidal volume and hence the respiration function. Pursed lips breathing was done to improve expiration by increasing expiration phase and prevent constriction of airway during expiration. Pursed lip breathing could reduce respiratory rate, shortness of breath, PaCO2 and improve tidal volume and oxygen saturation at rest. The markers observed were increasing tidal volume and decreasing respiratory rate. Active expiration increases the elasticity of diaphragm pressure and rib cage, where after the expiration muscles are relaxed, it is ready for the next
inspiration process. Improvement in patient’s respiration function was expected to resolve patients’ physiological problem. The study concluded that respiration control exercise could improve physiological response in patients with COPD exacerbation that was hospitalized.

Conventry, P. [5] did a systematic review to analyze the influence of several interventions towards anxiety and depression in COPD patients. From the researches reviewed, the intervention that could reduce anxiety and depression in COPD patient is relaxation (progressive muscle relaxation). The result obtained was reduced anxiety and depression level which was measured with several tools for anxiety such as HADS, STAI, SCL-Anxiety, BAI, SCL and N/A.

Causey, R [3] in his research mentioned that COPD patient must do a respiration exercise with pursed lips breathing (PLB), diaphragmatic breathing and coughing technique to improve their physical condition. PLB has been proven to decrease lung hyperinflation in COPD patients and increase oxygen uptake. This technique has also been proven to reduce respiratory rate and anxiety in COPD patients. Causey’s qualitative research obtained an information from the respondent that after breathing exercise, patient's anxiety were decreased, followed by decreased respiratory rate, decreased frequency of micturition, and improvement in nutrition status.

Anxiety causes psychological and physiological changes in the patient. Physiological response that usually accompanies anxiety are increased blood pressure, increased pulse rate, palpitation, increased respiratory rate, dry lips, muscle tension and diarrhea. These responses emerge due to activation of autonomic nervous system and arteriolar vasoconstriction. These responses started with stress, which provoke anxiety which then activate the central nerve system – hypothalamus activation – pituitary glands – adrenal axis and sympathetic nerves that respond by increasing blood pressure, increasing pulse rate, and respiratory rate.

This research shows that there were significant physiological changes after 7 days of intervention which could be seen from the change in blood pressure, pulse rate and respiratory rate after day 7. Breathing relaxation for 3 days did not produce significant changes in physiological response, especially in blood pressure (only significant in pulse rate and respiratory rate). Puspita [11] explained that there are several factors causing anxiety among patients during hospitalization, such as physical condition, environment, limitations and individual’s coping mechanism. Physical condition of the patients is related to the disease and symptoms of the patients. Environment is related to the physical environment of the hospital, the behavior of the nurse and hospital staff, and social environment between patients. Anxiety occurs because of limitation in such as limited activities, social limitations (separated from family), and economic limitations. The insignificant change in blood pressure may be caused by ongoing anxiety caused by several factors mentioned above; this is because in the day 3 of intervention, several respondents were still hospitalized, while in day 7 some respondents had been discharged.

Breathing exercise, breathing relaxation or any relaxation intervention is one of the independent actions of nurses. The interventions are available in nursing intervention classification book, which is nurse's guidance in providing nursing care and intervention to the patient. The interventions could be catered to patients with nursing problems such as discomfort and pain, respiratory problem (breathing pattern, and respiratory tract’s discharge) and also used for anxiety management. The interventions were also used by many researchers in the nursing field as an independent act to solve patient’s problem, especially in patients with cardiovascular system and respiration system problems.

Clinical value of the physiological variables measured, such as blood pressure, pulse rate and respiratory rate in COPD patient have changed after intervention. PDPI [10] mentioned that COPD patient would have a blood pressure in mild hypertension range (systolic pressure 140-159 mmHg) to severe hypertension (systolic pressure 160-179 mmHg). The pulse frequency of the COPD patients was 60-100 x/minutes and the respiratory rate was 16-25 x/minutes. The guidebook mentioned that COPD patients with respiratory rate >25 must be treated with oxygen therapy. The research shows that maximum systolic pressure reached 190 (severe hypertension), pulse rate 125 x/minutes (tachycardia) and respiratory rate 29 x/minutes. After 7 days of intervention, blood pressure, pulse rate, and respiratory rate decreased to the normal range for COPD patients where blood pressure is in mild hypertension (140 mmHg), pulse rate is in normal range (96 x/minute) and respiratory rate is in the normal range (24 x/minute). This shows that balloon blowing intervention produced significant positive changes in physiological variables after 7 days of intervention.

V. CONCLUSION

1. The mean blood pressure, pulse rate, and respiratory rate of COPD patient before intervention were
abnormal; all three of them were above the normal range.
2. Pulse rate and respiratory rate of COPD patient decreased significantly, from the value before intervention, after 3 days of intervention with balloon blowing. Blood pressure did not change significantly after 3 days of intervention.
3. Physiological response measured, blood pressure, pulse rate, and respiratory rate have changed significantly from before and after intervention with balloon blowing for 7 days.
4. Breathing relaxation with balloon blowing technique caused significant physiological changes, measured from the blood pressure, pulse rate and respiratory rate of COPD patients in Flamboyan room of RSUD Dr. Soedomo Trenggalek, East Java.

VI. SUGGESTION
This study had several limitations. First, the subjects were limited to 36 respondents of COPD patient in a group of intervention. Second, the relative resistance of the balloons was not constant because of individual differences. Therefore, for future studies need to be conducted with control group, measuring the balloon resistance accurately.

REFERENCES