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Deep Breathing And Active Range Of Motion Exercises For Increasing Oxygen Saturation In Patients With Congestive Heart Failure

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Abstrak

Dsypnea adalah manifestasi klinis CHF karena kegagalan fungsi paru. Akumulasi cairan dalam alveoli membuat jantung tidak mampu memompa dengan maksimal sehingga akan membuat otot pernapasan meningkatkan sensasi dispnea. Hal ini akan membuat peningkatan frekuensi pernapasan, tekanan darah, denyut nadi dan penurunan saturasi oksigen. Perubahan tersebut akan mempengaruhi kualitas hidup pasien. Intervensi farmakologis dan nonfarmakologis dilakukan untuk menjaga stabilitas fisik, menghindari perilaku yang dapat memperburuk kondisi dan mendeteksi gejala awal gagal jantung yang memburuk. Latihan pernapasan dalam dan rentang gerak aktif adalah salah satu intervensi non-farmakologis untuk mengurangi pernapasan dan meningkatkan kekuatan otot pernapasan. Tujuan dari penelitian ini adalah untuk mengidentifikasi saturasi oksigen setelah latihan pernapasan dalam dan active range of motion. Rancangan penelitian yang digunakan adalah penelitian eksperimen semu yang melibatkan 16 responden dengan teknik purposive sampling. Latihan pernapasan dalam dan rentang gerak aktif dilakukan 3 kali sehari selama 3 hari. Alat ukur yang digunakan adalah pulse oximetry. Analisis data menggunakan paired t-test. Hasil penelitian menunjukkan peningkatan saturasi oksigen sebesar 1,69%. Ini menunjukkan efek intervensi latihan pernapasan dalam dan rentang gerak aktif pada saturasi oksigen (p = 0,000, α <0,05). Kesimpulannya, latihan sebagai metode untuk meningkatkan saturasi oksigen pada pasien dengan CHF. Penelitian ini merekomendasikan bahwa intervensi deep breathing exercise dan active range of motion dapat digunakan sebagai intervensi mandiri dan dapat dikolaborasikan dengan fisioterapis

Kata kunci *: Latihan Pernapasan Dalam, Rentang Gerak Aktif, Saturasi Oksigen*

Abstract

Dsypnea is a clinical manifestation of CHF due to pulmonary function failure. The accumulation of fluid in the alveoli makes the heart unable to pump with the maximum. This will increase the respiratory frequency, blood pressure, pulse and decrease oxygen saturation. These change will affect the quality of life of patients. Pharmacologic and nonpharmacologic management is performed to maintain physical stability, avoid behaviors that can aggravate the condition and detect early symptoms of worsening heart failure. Deep breathing exercise and active range of motion is one of the non-pharmacological interventions to reduce breathing and increase respiratory muscle strength. The purpose of this study was to identification oxygen saturation after deep breathing exercise and active range of motion. The type of research used is quasi experimental research involving 16 respondents with purposive sampling technique. Deep breathing exercise and active range of motion performed 3 times a day for 3 days. The measuring instrument used is pulse oximetry. Data analysis using paired t-test. The results showed an increase in oxygen saturation of 1.69%. This shows the effect of deep breathing exercise intervention

and active range of motion on oxygen saturation (p=0,000, α <0.05). In conclusion, the exercise as a method to increase oxygen saturation in patients with CHF. This study recommends that exercise interventions can be used as self-care nursing interventions.

***Keywords**: Active Range Of Motion, Deep Breathing Exercise,Oxygen Saturation*

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INTRODUCTION

Heart and blood vessel disease is one of the main health problems in both developed and developing countries. This disease is the number one cause of death in the world with an estimated increase of 23.3 million in 2030 (1 , 2) The problem is also a progressive health problem with high mortality and morbidity in Indonesia (3) The result of Basic Health Research (Riskesdas) by Kemenkes RI in 2013, the prevalence of heart failure in Indonesia reached 0.13% from the total population aged 18 years and above (4). The highest prevalence of heart failure based on the doctors diagnosis is in the Special Region of Yogyakarta, which is equal to 0.25% (2, 3).

The increasing prevalence will provide problems such as illness, disability and socio-economic problems for families of patients, society, and the State (2 , 5). The results of a preliminary study at PKU Muhammadiyah Hospital in Yogyakarta found that the number of Congestive Heart Failure (CHF) patients treated in 2015 and 2016 without comorbidities other than respiratory disease are 328 patients (6).

Signs and symptoms in patients with CHF include dyspnea, fatigue and anxiety. Dyspnea is a symptom that is frequently occure in CHF sufferers accompanied by a decrease in oxygen saturation. The results of interviews with 8 patients in the hospital, 80% of patients stated that dyspnea disturbed them especially in their daily activities. Pulmonary edema due to CHF causes in failure of pulmonary function and changes in the respiratory muscles. This causes the reduced oxygen supply so that oxygene saturation decreases and dyspnea symptoms arise (7,8).

Dyspnea in CHF patients is also influenced by patient activity so that the New York Heart Association (NYHA) divides CHF into 4 categories based on the signs and symptoms of the activities carried out (7,8) Patients with NYHA IV will pant every day even during mild activities or while resting. This is because dyspnea affects the decrease in tissue oxygenation and energy production so that the patients ability in their daily activities will also decrease which can reduce their quality of life (9). Systematic review and meta-analysis research revealed rehabilitation of heart failure can be performed of NYHA II and NYHA III because they have low and moderate risk (10).

Nurses as providers of nursing care through independent and collaborative actions facilitate patients to solve problems. One of the nursing diagnosis from NANDA in patients with CHF is the decrease in cardiac output (11). The picture that occurred in PKU Muhammadiyah Hospital in Yogyakarta and PKU Muhammadiyah Hospital in Gamping, Yogyakarta showed that there were no independent interventions for cardiovascular rehabilitation. Interventions in hospital are made for all patient case such as gradual mobilitation. Cardiovascular rehabilitation should be an

intervenstion with standar operating procedures that ae specific to cardiovascular patients for maximum results. The results of interviews with medical rehabilitation found that the heart rehabilitation program in patients includes three sessions namely warm-up, training phase, and cooling using ergocycle.

Pharmacological Management conducted such as the provision of cardiac glycosides, diuretic therapy, and vasodilator therapy. Non-pharmacological management that can be done is education, exercise and increased functional capacity. One of the intervention to dyspnea problems can be done by giving oxygenation to reduce respiratory rate. Positioning and breathing exercise can be done to improve respiratory muscle function. Tolerable physical exercise also becomes management in improving tissue perfusion and facilitating circulation (12,13).

AHA recommends that physical exercise be carried out in patients with stable CHF. Physical exercise is done in 20-30 minutes with a frequency of 3-5 times each week. Before starting the exercise, patients with CHF requires a comprehensive assessment to stratify the risk and advised to rest when tired. This exercise is one of the physical exercise in hospital that can be performed for patients with NYHA II and III. Management of gradual activity can create condition of peripheral blood circulation and tissue perfusion better (14,15).

Breathing exercise is an exercise to improve breathing and functional performance (16). One of the breathing exercises that can be done is deep breathing exercise. It is nursing activity which improves the ability of the respiratory muscles to increase lung compliance in improving ventilation function and improve oxygenation. Increased oxygen saturation in patients within the normal range is the expected result (13,17).

Study on breathing exercise in heart failure patients conducted by Sepdianto showed an increase in oxygen saturation with p = 0,000 (18). Six studies on systematic review showed that breathing exercises have the effect of increasing the strength of respiratory muscles so that they can increase oxygen into the body. A systematic review study with 27 studies showed that physical exercise can increase oxygen saturation and quality of life in heart failure patients (19,20). In Indonesia, the use of deep breathing exercise and active range of motion as nursing interventions to increase oxygen saturation in CHF patients has not been widely performed. Does deep breathing exercise and active range of motion increase oxygen saturation? This question encourages researchers to find out the effect of deep breathing exercise and active range of motion on increasing oxygen saturation in CHF patients in PKU Muhammadiyah Yogyakarta Hospital and PKU Muhammadiyah Gamping Yogyakarta.

MATERIALS AND METHODS

This study is a quasi-experimental study conducted at PKU Muhammadiyah Hospital in Yogyakarta and PKU Muhammadiyah Hospital in Gamping, Yogyakarta. The study involved 16 respondents with stratified random sampling techniques from May to June 2017. The inclusion criteria were patients with stable hemodynamic status, patients who did not experience weakness in both extremities, patients aged ≥18 years, and patients who received the same pharmacological therapy. The exclusion criteria were patients with respiratory disease, neuro-musculo-skeletal disease, severe systemic disorders, mental and communication disorders and respiratory disease. Patient with pulmonary disease who have inspiratory muscle weakness in the improvement of respiratory muscle function and dyspnea at rest and during exercise (21). The independent variables in this study are deep breathing exercise and active range of motion. The dependent variable of the study is oxygen saturation.

Interventions consist of deep breathing exercise and active range of motion. The researcher measured oxygen saturation with pulse oxymetry. Pulse oximetry has been calibrated before use. Measurements were taken 15 minutes before the intervention began and 15 minutes after the intervention ended. The patient is positioned semi fowler first. The intervention began 48 hours after the patient entered the hospital. The exercise began with a deep breathing exercise for 30 times followed by an active range of motion gradually on the hands, feet, hips, and knees with each movement carried out for 5 times. The exercise was carried out three times a day for three days.

Data were evaluated by entering into database prepared in statistics program. Univariate in this study used descriptive analysis, namely the frequency distribution and percentage. Whereas for bivariate analysis was used paired t-test.

Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, Diponegoro University. The number of ethical approval was 202/EC/FK-RSDK/IV/2017. Respondents were asked to sign the informed consent when they were willing to participate in this study.

RESULTS AND DISCUSSION

The result of study showed that were 16 respondents participate in this study. Distribution of variables related to characteristics of respondents are seen on Table 1

.

Characteristics of Respondents

The age of the respondents were mostly > 60 years. The comparison of male and female respondents is 3 to 4 while respondents with CHF NYHA II and NYHA III are in the same number. Respondents received the same pharmacological therapy as the largest percentage on diuretic drugs.

Table 1. Characteristics of Responden in PKU Muhammadiyah Yogyakarta Hospital and PKU Muhammadiyah Gamping Hospital Yogyakarta May-July 2017 (n= 16)

Characteristics of Respondents	Total f (%)
Age	
18 – 45 years old	2 (12,5)
46 – 60 years old	3 (18,8)
> 60 years old	11 (68,8)
Sex	
Male	7 (43,8)
Female	9 (56,2)
CHF Classifications	
NYHA II	8 (50)
NYHA III	8 (50)
Pharmacological therapy	
Diuretic drug	6 (37,5)
Vasodilator drug	3 (18,8)
Diuretic and vasodilator drug	7 (43,8)

The Average Increase in Oxygen Saturation

Distribution of variable related to the average increase in oxygen saturation before and after exercise is seen on Table 2.

Table 2. The Average Increase Oxygen Saturation Before and After *Deep Breathing Exercise* and *Active Range of Motion*

Variable		Mean	SD	p
Oxygen Saturation	Before	95.81	1.60	0,000
	After	97.50	1.03	

Oxygen saturation increased by 1.69% after deep breathing exercise intervention and active range of motion. This shows the influence of deep breathing exercise intervention and active range of motion on oxygen saturation ($p = 0,000$, $a<0,05$).

Increased Oxygen Saturation

The results showed that deep breathing exercise and active range of motion were able to increase the oxygen saturation of CHF patients up to 1.69%. The results of this study are in accordance with Sepdianto's research. The results of the study showed that breathing exercises were able to increase oxygen saturation by 0.8% (9). Another study conducted

by Bernadi with an one-month breathing exercise intervention in 50 heart failure patients showed an increase from 92.5%±0.3 to 93.2%±0.4 (21). The study by Sivakumaar showed that deep breathing for 2-5 minutes has an acute effect on a significant increase in lung function ability shortly after being given so that it can affect the oxygen saturation values (22). In 2016, a systematic review of 27 study showed that physical exercise can increase oxygen saturation and quality of deep breathing exercise and motion active range will increase oxygenation in the human body. Deep breathing exercise is respiration techniques used for taking respiration under control. This exercise will stimulate the spread of surfactants secreted by alveolar cells type II. The release of surfactant will cause surface tension in the alveoli to be reduced and improve lung function of life in heart failure patients (19,20).

Deep breathing exercise increases gas exchange, lowers respiratory rate, increases tidal volume, and increases activity of inspiratory and expiratory muscles. Diaphragm is pushed upward by abdominal muscles during expiration at diaphragmatic respiration. The respiratory muscles and diaphragm will function optimally so that there is an increase in tidal volume, decreased functional residual capacity and increased oxygen intake optimally. This also increases efficiency of diaphragm as an inspiratory muscle. Because diaphragm muscle is used during diaphragmatic respiration instead of other muscles, respiratory work decreases and therefore, aeration level of lungs increases and respiration improves (22,23).

Active range of motion is one of exercise in cardiac rehabilitation. It have been demonstrated to improve ventilation and perfusion so it will improve pulmonary function and promote physical activity. During in hospital, exercise can start from hand and foot movements or posture changes. It can be done regularly and gradually. During exercise, lungs bring oxygen into the body and the heart pumps the oxygen to muscles. Regular exercise can increase strength and function of muscles. It also improves circulation and strengthens heart. Another benefit of this phase is to train patients to be able to carry out daily activities and to avoid negative physiological and psychological effects of bedrest.(24,25)

Based on the finding, it is recommended for this exercise improving oxygen saturation. Further study should attention another variable that may affect oxygen saturation, such as anemia and body temperature. Control variabels can be added to the study to obtain clearer effectiveness.

CONCLUSION AND RECOMMENDATION

According the study result, breathing exercises and motion active range applied to patients with CHF improve oxygen saturation. This information may motivate CHF patients to practice breathing exercises and active range of motion. Larger, well designed trial to access objective and subjective measures of oxygen saturation will help to clarify the emerging role of breathing exercise and active range of motion as an important non-pharmacological therapy for CHF.

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