

THE EFFECTIVENESS OF CHEST PHYSIOTHERAPY WITH TRIPOD AND FOWLER POSITION TO INCREASING OXYGEN SATURATION

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) is one of the three leading causes of death in the world in low and middle-income countries up to 90%, characterized by airway obstruction making it difficult for the body to transport sufficient oxygen. This study examines chest physiotherapy with a tripod and Fowler's position in oxygen saturation. Quantitative analysis using a quasi-experimental method and two-group pre-test-posttest design with 50 samples using an accidental sampling technique. Statistical test using unpaired t-test showed a significant difference in average oxygen saturation using a tripod position with a P-Value of 0.00. The tripod position showed better results as indicated by the increase in oxygen saturation from 93.40 to 97.64 compared to the Fowler position which increased from 92.64% to 95.52. Therefore, this study suggests chest physiotherapy using a tripod position is more effective in increasing oxygen saturation in COPD patients. This intervention can remove secretions, help reduce shortness of breath in patients, and affect the value of increasing oxygen saturation in COPD patients. This non-pharmacological action is a nursing intervention based on scientific evidence for independent nursing actions in providing nursing care to COPD patients

Keywords: COPD, Chest Physiotherapy, Tripod Position, Fowler's Position, Oxygen Saturation

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common preventable and treatable disease characterized by persistent respiratory symptoms and airflow limitation caused by abnormalities in the airways in the alveoli so that host factors and exposure influence abnormal lung development. Significant exposure to noxious particles or gases impacts morbidity and mortality in comorbid patients (Gold, 2021).

The disease is one of the three leading causes of death worldwide in low- and middle-income countries up to 90% (Gold, 2021). The high smoking prevalence in the population (28.8% for the age > 10 years) illustrates the very high risk for the Indonesian population to experience COPD (Ministry of Health RI Agency for Research and Development, 2018).

The symptom of COPD is indicated by chronic and progressive dyspnea. A study by Agustí, Beasley, Celli (2019) discloses that 30% of COPD patients had cough with sputum production. These symptoms can vary from day to day and can precede the development of airflow limitation by years. Significant airflow limitation may also occur without chronic dyspnea and/or cough and sputum production and vice versa. Circulation and lung problems can make it harder for the body to absorb or transport enough oxygen, lowering oxygen saturation levels. Oxygen saturation measures how much oxygen the hemoglobin can carry.

Spirometry is the most reproducible and objective measurement of airflow limitation. Despite its good sensitivity, peak expiratory flow measurement alone cannot be relied upon as the sole diagnostic test because of its poor specificity. Spirometry should measure the volume of air forcibly exhaled from the point of maximal inspiration (forced vital capacity, FVC) and the volume of air exhaled during the first second of this maneuver (forced expiratory volume in one second, FEV1), and count the ratio of these two measurements (FEV1/FVC). The ratio between FEV1 and slow vital capacity (VC), FEV1/VC, is sometimes measured instead of the FEV1/FVC ratio (Zuriati, Suriya, & Ananda 2017).

Handling non-pharmacological nursing interventions in cases of decreased oxygen saturation does not further impact hypoxemia, hypoxia, and cyanosis is carried out by providing therapy, namely chest physiotherapy and adjusting the tripod and fowler positions. Chest physiotherapy is beneficial for people with respiratory diseases, both acute and chronic. Chest physiotherapy is commonly used to treat and prevent patients with Chronic Obstructive Pulmonary Disease,

restrictive respiratory diseases--including neuromuscular disorders, and lung disease in treating the effectiveness of airway clearance. Various types of chest physiotherapy, namely chest percussion, vibration, and Postural Drainage (PD), increase the patient's oxygen saturation with ineffective airway clearance (Zuriati, Suriya, and Ananda 2017).

A nurse can do other non-Pharmacological measures given in breathing exercises to help the airway. Research conducted at Cairo University by Hussen (2011), as cited by Maidartati (2014), reported that Chest physiotherapy (CPT) is effective in improving airway clearance in infants with pneumonia evaluated of decreased oxygen demand. Another option is setting a comfortable resting position so that the additional breathing muscles may work adequately by using a tripod or a fowler position.

The tripod position is the client's position on the bed, resting on the overbed table (which is raised to the appropriate height) and resting on both hands with the legs bent inward. Patients who are given a tripod position can be assisted to improve chest expansion. The trick is to adjust the patient's sitting position slightly, leaning forward by resting on both hands on the bed with both feet in position (Zuriati, Surya, & Zahlimar, 2020).

A sitting position or position is a position in bed with the head and body elevated, and the knees can be flexed or not flexed. The Fowler's position is helpful to focus the diaphragm and expand the lungs. It can be done by adjusting the position of the head in a semi-sitting position with a pillow or by adjusting the patient's bed by elevating the top of the head. Adjusting the Fowler's position in patients with cardiopulmonary disease using gravity can help expand the lungs and reduce pressure from the abdomen on the diaphragm. The purpose of this action is to reduce shortness of breath to increase oxygen saturation in COPD patients and maintain comfort. The stability of the breathing pattern is characterized by a standard respiratory rate, no oxygen insufficiency (hypoxia), changes in breathing patterns, and airway obstruction (Potter & Perry, 2010).

Research Methods

This study used a quasi-experimental quantitative method with a two-group pre and post-test design approach. It is a study of respondents to examine the differences in oxygen saturation before and after giving chest physiotherapy with a tripod and fowler position in patients with chronic obstructive pulmonary disease. The independent variables are the chest physiotherapy treatment with a tripod and fowler position, while the dependent variable is oxygen saturation. The population in this study were patients suffering from the chronic obstructive pulmonary disease at the Tarakan Hospital, Jakarta. With the number of samples of each treatment group 1 and 2 as many as 25 respondents with accidental sampling technique. The inclusion criteria were patients with COPD with impaired airway clearance who had checked oxygen saturation, while the inclusion criteria were patients with thoracic surgery and rib fractures. The analysis test was carried out by comparing the two treatment groups, namely the Independent T-test analysis test.

Result

Table 1 Effect of Oxygen Saturation Before and After Giving Chest Physiotherapy and Tripod Position with Fowler's Position (paired t-test).

Group		N	Mean	P-Value	T
Chest Physiotherapy and Tripod	Before	25	93,40	0.00	11,629
	After	25	97.64		
Chest Physiotherapy and Fowler	Before	25	92.64	0.00	5,039
	After	25	95.52		

Table 1 shows that Chest Physiotherapy The tripod position result indicated by the increase of oxygen saturation from 93.40 to 97.64 (or 4.54%), whereas to the Chest Physiotherapy and fowler position that increases from 92.64% to 95.52 (or 2.98%)

Table 2 The Effectiveness of Comparison of Oxygen Saturation of the Group Given Chest Physiotherapy and Tripod Position with the Chest Physiotherapy Group and Fowler's Position

Variable	Group	N	Mean	SD	T	P-Value
Oxygen Saturation	Chest Physiotherapy and Tripod	25	95,40	1,65831		
	Chest Physiotherapy and Fowler	25	97,6400	,95219	6,441	0.00

Table 2 shows that Chest Physiotherapy and the tripod position are more effective shows the result indicated oxygen saturation mean of 95.40, SD 1.65831, compared to the fowler position show which means 97.6400, SD 0,95219. The results of the analysis using the results of the Independent T-test analysis on the oxygen saturation of the chest physiotherapy of the Tripod group and the chest physiotherapy of the fowler group obtained a p-value = 0.00. The results indicate a difference between the chest physiotherapy group and the tripod and chest physiotherapy group and Fowler with the results that are significant in the chest physiotherapy and Tripod group.

Discussion

The above data shows that the p-value of 0.00 when doing intervention by using tripod and fowler position. The results indicate a significant difference between the effect of giving physiotherapy and tripod position to physiotherapy and Fowler's position. Another independent T-test analysis indicates a similar result with a p-value of 0.00, implying a difference between the chest physiotherapy of the Tripod and the fowler group with the standard deviation of 1.65.

The result agrees with the study of Maidartati (2014), which reported the effect of chest physiotherapy on airway clearance in children aged 1-5 years. She found a significant difference in the mean frequency of airway clearance before and after physiotherapy with the P-value of 0.00, while for the respiratory clearance, she reported a P-value of 0.225. Other researchers (Rosa et al., 2018) also reported a significant difference between before and after being given chest physiotherapy, which indicates that chest physiotherapy may significantly increase oxygen saturation. Another study by Muliastari (2018) stated a significant difference between oxygenation status before and after chest physiotherapy intervention and respiratory rate (RR), which increases up to 45.6%.

In addition to the previous studies, Siti Maimuna et al. (2014) also studied the effectiveness of clapping and vibrating on the cleanliness of the client's airway with mechanical ventilation. Her analysis using a paired t-test examined the oxygen saturation in the treatment group obtained a P-Value of 0.00, which indicates an effect of clapping and vibration on oxygen saturation before and after the treatment. In the control group, the p-value shows the value of 0.078, which means that there is no effect between clapping and vibration on oxygen saturation. In contrast, the Independent T-test analysis results on the oxygen saturation of the treatment group and the control group obtained a value of p = 0.00, which means there is a difference between the treatment group and the control group.

Another with same similar study related to the effect of tripod position in increasing oxygen saturation was conducted by (Zuriati, Surya, & Zahlimar 2020). They focused on the Effectiveness Active Cycle of Breathing Technique (ACBT) with Pursed Lips Breathing Technique (PLBT) to tripod position to increase oxygen saturation in patients with COPD. The result indicates a significant difference in mean oxygen saturation before and after ACBT and tripod position with a P-value of 0.000. A five minutes intervention for three consecutive days reported reduces the shortness of breath in COPD patients. Giving a tripod position in COPD patients will elevate the diaphragm and external intercostal muscles to a position of approximately 45 degrees. The diaphragm and external intercostal are the primary inspiratory muscles. The diaphragm muscle, which is at a 45-degree position, causes the earth's gravitational force to work adequately on the

primary inspiratory muscle, making it easier for the muscle to move downward, increasing the volume of the chest cavity by increasing the vertical length. The enlarged chest cavity causes pressure in the chest cavity to expand and forces the lungs to expand. Increased ventilation in patients with shortness of breath who have been positioned on a tripod will increase the release of carbon dioxide and increase the intake of oxygen into the intra-alveolar so that saturation in the body increases.

In COPD patients, there is a decrease in oxygen saturation with symptoms of shortness of breath experienced. Oxygen saturation is reduced because the amount of oxygen in red blood cells is low, which carries hemoglobin to the left heart and is channeled to the peripheral capillaries, resulting in disruption of oxygen supply in the blood in the arteries, which will hurt the patient's body (Zuriati, Suriya, & Ananda 2017). Other effects that often occur with oxygen saturation values decreasing continuously in COPD patients will result in hypoxemia and continue to become hypoxia, resulting in decreased daily functional activities, decreased concentration, and mood changes. The condition of COPD patients who are short of breath continuously lowers oxygen saturation so that cyanosis can occur (Zuriati, Suriya, & Ananda, 2017).

Oxygen saturation is the percentage of hemoglobin (Hb) bound to oxygen in the arteries, which in normal conditions should be is between 95–100%. Determination of oxygen by using oxygen saturation in the arteries in the examination of blood gas analysis. An increase in oxygen saturation can be influenced by several possibilities, including disruption of the oxygen diffusion process due to obstacles in the lungs and blood vessels so that the amount of oxygen bound to Hb decreases, the accumulation of secrets that can disrupt the process of tissue oxygenation due to inhibition of oxygen transport which is marked by a decrease in SaO₂. Circulation and patient activity where each of these factors have a role in increasing or decreasing oxygen saturation. Several techniques can do the measurement of oxygen saturation. The use of pulse oximetry is an effective technique to monitor patients for small or sudden changes in oxygen saturation (Kusumaningrum, 2015).

Kozier (2010) explains several factors that affect oxygen saturation in patients with ventilators, namely hemoglobin (Hb). Fulfilling this oxygen demand cannot be separated from the functional condition of the respiratory system. If there is a disturbance in one of the organs of the respiratory system, then the need for oxygen will be disturbed by many conditions that cause a person to experience disturbances in meeting oxygen needs, such as blockages in the respiratory tract (Black & Hawks, 2014). Ineffective airway clearance is a condition when an individual experiences an actual or potential threat to respiratory status due to an inability to cough effectively (Lynda, Juall, & Carpenito, 2016). Patients with ineffective airway clearance can be given chest physiotherapy, which is one of the practical nursing actions in reducing fluid/sputum buildup in the lungs (Black & Hawks, 2014).

Handling non-pharmacological nursing interventions in cases of decreased oxygen saturation does not further impact hypoxemia, hypoxia, and cyanosis is carried out by providing therapy, namely chest physiotherapy and adjusting the tripod and fowler positions. Chest physiotherapy is beneficial for people with respiratory diseases, both acute and chronic. Chest physiotherapy is commonly used to treat and prevent patients with Chronic Obstructive Pulmonary Disease, restrictive respiratory diseases, including neuromuscular disorders, and lung disease in treating the effectiveness of airway clearance.

Chest physiotherapy is a therapy used in combination to mobilize pulmonary secretions. Chest physiotherapy can release the retained secretions, loose, watery, and easy to remove, resulting in a clean airway, ventilation, and increased Hb binding, which is indicated by the value of oxygen saturation towards normal. Various types of chest physiotherapy, namely chest percussion, vibration, and Postural Drainage (PD), increase the patient's oxygen saturation with ineffective airway clearance (Zuriati, Suriya, and Ananda 2017).

Position settings that can relieve shortness of breath in COPD patients are tripod position and breathing exercises that can affect oxygen saturation, namely Active Cycle of Breathing Technique (ACBT) exercise (Zuriati, Surya, and Zahlimar 2020). Based on the literature that examines the increase in oxygen saturation in COPD patients by using either the tripod position or pursed lips breathing method, the results show that the tripod position and pursed lips breathing exercise can effectively increase oxygen saturation in COPD patients with shortness of breath attacks. Research on the tripod position carried out by (Zuriati, Surya, and Zahlimar 2020) shows that the tripod position can affect the respiratory process and increase oxygen saturation in COPD sufferers. Another research by Rusana, Ahmad Subandi, and Ida Ariani (2019) stated that of 28 asthma patients, the results showed a significant difference in oxygen saturation given a nebulizer before and after the fowler position intervention with a p-value < 0.05. The study indicates a significant difference in oxygen saturation in asthmatic patients with a nebulizer intervention before and after being given a high fowler position with a p-

value < 0.05. The results imply a difference in the effectiveness of the fowler and high fowler positions on oxygen saturation in asthmatic patients who are given a nebulizer with a p-value < 0, 05. This study concluded that the high fowler position was more effective in increasing oxygen saturation in asthmatic patients who were given a nebulizer than the fowler position.

Chest physiotherapy is implemented once a day using postural drainage, percussion, and vibration for 20 minutes and then a nurse to with a tripod or fowler position for 5 minutes. This intervention may remove secretions, help reduce shortness of breath in patients, and affect the value of increasing oxygen saturation in COPD patients. This non-pharmacological action is a nursing intervention based on scientific evidence-based practice for independent nursing action. Nurses can use the study results as an option for nurses in providing nursing care to COPD patients.

Conclusion

One of these non-pharmacological actions is a nursing intervention that can be used based on scientific evidence (evidence-based practice) for independent nursing action. The study suggests the uses of tripod and fowler position chest physiotherapy for nurses in providing nursing care to COPD patients. In addition, as a complementary therapy nurse, it is appropriate, effective, safe, affordable, and easy to use by trained nurses in the room for treatment that supports increasing oxygen saturation in patients with ineffective airway clearance patients.

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