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Active Cycle of Breathing Technique (ACBT) and Effective Coughing on Respiratory Rate Changes in COPD Patients

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ABSTRACT

Background: COPD is a chronic obstructive disease that causes breathing resistance, resulting in an increase in respiratory frequency. To reduce shortness of breath in COPD patients, independent nursing interventions can be carried out, one of which is providing a combination of Active Cycle of Breathing Technique (ACBT) techniques. In addition to loosening and relieving the respiratory tract.
Purpose: this study aimed to evaluate the effectiveness of Active Cycle of Breathing Technique (ACBT) and effective coughing in reducing respiratory rate among patients with Chronic Obstructive Pulmonary Disease (COPD).
Methods: using a pre-experimental design with a one-group pretest-posttest approach, 30 COPD patients from Dr. Wahidin Sudirohusodo Regional General Hospital were recruited via purposive sampling technique obtained as many as 30 people. Data collection techniques in this study were carried out by observing the value of respiratory rate before and after giving ACBT and effective cough. Data analysis using paired T-test.
Results: the results showed a significant decrease in respiratory rate after the intervention (mean pre-test: 24.97, post-test: 22.97; $p < 0.001$). These findings suggest that ACBT combined with effective coughing is an effective nursing intervention to manage respiratory symptoms in COPD patients.
Conclusion: the conclusion is that there is an effect of the combination of Active Cycle of Breathing Technique (ACBT) and Effective Coughing on changes in repiratory rate in COPD patients.

Keywords:
Active cycle of breathing technique; COPD; effective cough; respiratory rate.

BACKGROUND

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder that places a substantial burden on global healthcare systems. It is characterized by persistent airflow limitation, leading to symptoms such as shortness of breath, chronic cough, and sputum production. According to the global prevalence data, there were 299.4 million cases of COPD in 2019, with a decrease to 212.3 million cases in 2020 due to revised estimation methods (Naibaho, 2021). In Indonesia, the prevalence of COPD was recorded at 3.7%, equivalent to 9.2 million cases, based on the 2018 Riskesdas report (Kemenkes RI, 2019).

COPD is most prevalent among individuals aged 30–79 years, with higher prevalence in males due to smoking habits. Smoking is a major risk factor, with irritants such as nicotine, tar, and carbon monoxide damaging lung tissues and reducing respiratory function (Huriah & Wulandari, 2017). These conditions necessitate effective interventions to improve patients' respiratory function and quality of life.

Non-pharmacological interventions such as the Active Cycle of Breathing Technique (ACBT) and effective coughing are widely used for airway clearance and symptom management in COPD patients (Pratama, 2021). ACBT consists of three stages: breathing control, thoracic expansion exercises, and the forced expiration technique, which together help maintain respiratory muscle performance, clear mucus, and improve lung function (Syafriningrum & Sumarsono, 2022). Effective coughing complements ACBT by facilitating mucus expulsion, preventing secretion retention, and improving lung expansion (Maulabibi & Afni, 2023). These interventions are critical for reducing the frequency of exacerbations and improving clinical outcomes in COPD patients. This study focuses on evaluating the combined effect of ACBT and effective coughing on respiratory rate changes in COPD patients.

OBJECTIVE

The purpose of this study was to determine the effectiveness of Active Cycle of Breathing Technique (ACBT) and effective cough on changes in respiratory rate in COPD patients. In addition, it is also to identify the respiratory rate before and after the intervention. Data analysis using paired T-test.

METHODS

This research method is a Pre-experiment with a one-group Pre- Posttest approach design. The sample obtained was 30 respondents using a purposive sampling technique with inclusion criteria such as: 1) Respondents age between 17-65 years, 2) COPD patients with breathing apparatus in the form of a simple mask. While the exclusion criteria are COPD patients with non-pharmacological therapy and who have decreased consciousness. The study was conducted in the Jayanegara Room of Dr. Wahidin Sudirohusodo Mojokerto Regional General Hospital. Pretest measurement of respiratory rate was done before the patient was intervened. Post-test measurement of RR after the patient has completed therapy 3 times for 1 cycle in the same day. Intervention was carried out every day for 11 days, in 1 day 3 times for 1 cycle. After the data is collected, editing, coding, scoring, tabulating, and data analysis in the form of a paired T-test.

This study has met the principles of research ethics. This study has undergone ethical testing at the Dr. Wahidin Sudirohusodo Mojokerto Regional General Hospital and has received approval No: 400.14.5.4/765/417.805.1.3/2024.

RESULTS

Table 1. Respondent Characteristics

Characteristics	n	%
Age		
17-25 years	4	13,3
26-45 years	26	86,7
46-65 years	0	0
Gender		
Male	23	76,7
Female	7	23,3
History of smoking		
Yes	23	76,7
No	7	23,3

Table 1 above shows that the characteristics of respondents based on age are more than half of the respondents aged 26-45 years as many as 26 respondents (86.7%). Respondents were more male, namely 23 respondents (76.7%). The results of smoking history obtained almost all respondents smoked as many as 23 respondents (76.7%).

Table 2. Frequency Distribution Based on Respiratory Rate Before and After Giving Intervention

Variabel	Minimal	Maksimal	Mean	Std.Deviation	p-value
Respiratory Rate Pre-Test	22	29	24,9667	1,51960	0,000
Respiratory Rate Posttest	21	26	22,9667	1,60781	

Table 2. shows the results of respiratory rate before ACBT therapy and effective cough from 30 respondents, the minimum respiratory rate value is 22 and the maximum value is 29 with an average value of 24.9667 and a Std.Deviation value of 1.51960. after ACBT therapy and Effective Cough from 30 respondents, the minimum respiratory rate value is 21 and the maximum value is 26 with an average value of 22.9667 and a Std.Deviation value of 1.60781. The paired T-test results show a p-value of 0.000, meaning that there is an effect of the combination of Active Cycle of Breathing Technique (ACBT) and effective cough on changes in respiratory rate in COPD patients.

DISCUSSION

Based on table 1. obtained results based on age more than half of the respondents were

26-45 years old as many as 26 respondents (86.7%), 23 male respondents (76.7%) and 23 respondents (76.7%) smoked.

This is consistent with the hypothesis that lung function declines with age due to decreased flexibility of the lung tissue and chest wall, making it difficult to breathe. Damage to lung tissue causes constriction of the tiny bronchi, which close or become blocked early in the expiratory phase, allowing air to easily enter the alveolus and accumulate (Damer, 2023). Several prior research has found that the prevalence of COPD rises dramatically with age. Age is frequently mentioned as one of the risk factors for COPD. According to Mukhtar's (2017) research, COPD sufferers were more likely to be male than female. COPD patients were predominantly male respondents, totaling 57 (80.28%).

Furthermore, a person's smoking history can influence the development of COPD. This hypothesis may be consistent with the fact that smoking is one of the risk factors for COPD, which is more common in men than women. According to WHO (2023), Indonesia has 67.4% male active smokers and 4.5% female passive smokers. Smoking impairs the function of the lungs, heart, and blood vessels. According to Huriah and Wulandari (2017), the occurrence of COPD in smokers is caused by irritant and poisonous compounds found in cigarettes such as nicotine, carbon monoxide, and tar.

Data Table 2 above, obtained the results of respiratory rate before ACBT and Effective Cough therapy, namely the minimum value before (Pre-Test) is 22 and the maximum value is 29 out of 30 respondents with a mean pre-test value of 24.9667 and a Std. deviation value of 1.51960.

John E. Hall's Guyton and Hall Textbook of Medical Physiology is a popular reference source. This book explains in depth how respiration works and what normal physiological factors are, such as respiratory rate. According to Margareth Theory (2021), COPD patients' shortness of breath is caused by bronchial inflammation and swelling, increased mucus production, loss of airway elastic recoil, collapse of bronchioles, and redistribution of air to functional alveoli. As the alveolar wall is injured, the alveolar surface area in direct contact with the lung decreases, resulting in poor oxygen transport. This impairment to oxygen diffusion will cause hypoxemia. Shortness of breath in COPD patients is caused by sputum retention, which causes airway difficulties and induces rapid breathing. This causes an increase in the performance of the respiratory muscles when attempting to get oxygen into the body, resulting in an erratic breathing pattern.

This study is consistent with Huriah and Wulandari's (2017) findings, which show that after receiving ACBT therapy, respondents' shortness of breath falls to a scale of 1. These findings are consistent with the classification in the modified borg scale, where 0-3 represents no shortness of breath to moderate shortness of breath. This study is supported by Cahyono & Yuniartika, (2020) research, which states that ACBT therapy is effective for overcoming shortness of breath in COPD patients, as complaints of shortness of breath decrease more quickly due to mucus discharge from the respiratory tract and an increase in respiratory rate.

The combination of ACBT and Effective Cough Therapy can train tidal volume breathing to reduce shortness of breath. This can help relax the respiratory system and alleviate symptoms such as short/heavy breathing, tightness, and anxiety (Syafriningrum & Sumarsono, 2023). ACBT therapy is the primary driver of airflow, resulting in an increase in linear velocity adequate to shed secretions from the airway wall and the use of abdominal muscles to assist in pushing air out, which is a forced expiratory motion to move secretions (Ningtias, 2020).

When doing ACBT therapy, the patient will regulate their breathing by inhaling slowly with a little energy and focusing on inspiration, which will assist loosen the secretions in their lungs. When undergoing ACBT therapy, the patient will also train the vital capacity of the lungs to enhance the amount of breath. ACBT therapy is divided into four cycles. In the first cycle, Breathing Control can assist relax the respiratory tract and alleviate symptoms such as short/heavy breathing, tightness, and anxiety. This cycle will improve tidal volume breathing and lessen complaints of shortness of breath during ACBT therapy (Mardianti et al., 2022). The second cycle, Thoracic Expansion Exercise, will concentrate on inspiration/inhaling to assist release pulmonary secretions. Cycles that improve lung vital capacity help to increase breathing volume during ACBT therapy. The third cycle, Forced Expiration Technique, will involve the use of a forced expiratory maneuver to loosen secretions from the airway wall and encourage the movement of secretions out of the respiratory tract, allowing accumulated sputum to be pushed out and O2 and CO2 gas exchange to occur smoothly and without obstruction (Zuriati & Surya, 2020).

Followed by Effective Cough Therapy, which consists of five phases, the first of which is to encourage patients to drink warm water for 30 minutes before the action, which attempts to dilute sputum so that it can be easily removed. The second stage is to situate the patient in an upright or semi-fowler position on a chair or bed, with a mat or pad placed on his or her lap. The third step involves placing one hand on the chest and one on the abdomen. Step four is to take a deep breath, hold it for three seconds, and then gently exhale through your mouth. Step five is to cough hard just after the third breath and then throw the sputum into the sputum pot.

From the above statement, the researcher argues that ACBT therapy is a breathing exercise that can be done for nursing management in dealing with patients with respiratory system problems. ACBT therapy is able to reduce complaints of shortness of breath due to mucus discharge from the respiratory tract and an increase in respiratory rate.

CONCLUSION

The study revealed that the combination of Active Cycle of Breathing Technique (ACBT) and effective coughing significantly reduced respiratory rates in COPD patients, as evidenced by a decrease in the average respiratory rate from 24.97 breaths per minute before intervention to 22.97 breaths per minute after intervention ($p < 0.001$). This finding highlights the efficacy of these non-pharmacological nursing interventions in managing respiratory symptoms and promoting respiratory efficiency in

COPD patients. Regular implementation of ACBT and effective coughing is recommended as part of routine nursing care to optimize outcomes for patients with compromised respiratory function. Future studies with larger and more diverse populations are suggested to validate these findings and explore long-term benefits.

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