




Active Cycle of Breathing Technique: The Right Choice for Ineffective Airway Clearance Nursing Problem

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ARTICLE INFO

Article History:

Submitted: 02-01-2024

Revised: 10-02-2024

Accepted: 28-02-2024

 doi.org/10.58545/jkmi.v3i1.229

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ABSTRACT

Background: Management of secretions is one of the main problems faced in the medical condition of respiratory disorders. the use of complementary therapy techniques to treat airway clearance such as the active cycle of breathing technique is still low when compared with other interventions in treating respiratory problems. **Aims:** The research aims to determine the effectiveness of providing active cycle of breathing technique therapy to overcome nursing problems ineffectiveness airway clearance in nursing care. **Method:** This type of research is a case study using nursing care methods. The research sample was patients treated in the Catleya room at Dr. Soebandi Jember Hospital. Patients are given nursing intervention in the form of therapy active cycle of breathing technique for 4 consecutive days 2 times a day for 15-20 minutes with 3 cycles. **Results:** providing active cycle of breathing technique therapy can reduce nursing problems ineffectiveness airway clearance. Providing active cycle of breathing technique therapy effectively shows improvements in conditions such as improved respiratory frequency, reduced shortness of breath, and decreased sputum production. **Conclusion:** providing active cycle of breathing technique therapy effectively solve nursing problems ineffectiveness airway clearance. **Keywords:** Active Cycle of Breathing, Airway clearance, Breathing Technique

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How to cite:

Kushariyadi, Sujarwanto, & Rosyida, A., Q. (2024). Active Cycle of Breathing Technique: The Right Choice for Ineffective Airway Clearance Nursing Problem. *Jurnal Kegawatdaruratan Medis Indonesia*, 3(1), 90–103.

<https://doi.org/10.58545/jkmi.v3i1.229>

I. INTRODUCTION

Research shows that complementary therapies such as active cycle of breathing technique (ACBT) are still low compared to other interventions to overcome the ineffectiveness of airway clearance (Gaspar et al., 2019). The results of research in the

form of a systematic review and meta-analysis show that the active cycle of breathing technique intervention is proven to be relatively good in terms of volume, quality and consistency for dealing with cleaning secretions (Lewis et al., 2012). Independent nursing action to overcome

the problem of shortness of breath in patients is the deep breathing relaxation technique, while the active cycle of breathing technique has never been used. Based-on observations in the Catleya inpatient room, Dr. Soebandi Jember Hospital that ACBT therapy has never been used to overcome nursing problems ineffectiveness airway clearance.

The results of research regarding the use of airway clearance techniques (ACT) such as active cycle of breathing, forced expiratory technique, and autogenic drainage were 8.3% (Gaspar et al., 2019). The results of research in Australia show that airway clearance techniques that are often used in adult patients include huffing 92%, exercise 89%, and the active cycle of breathing technique 89% (Phillips et al., 2021). The results of research in Turkey showed that ACBT therapy was used in 40 bronchiectasis patients treated at Chest Diseases Department University Medical Faculty Hospital can increase sputum production (Üzmezoğlu et al., 2018). The results of research in China showed that the ACBT technique was given to 100 COPD patients who were treated at department of respiratory medicine at the Medical Center in Changchun, China can significantly improve sputum production and respiratory function in COPD patients (Shen et al., 2021).

Factors causing the low use of ACBT therapy in patients with respiratory problems include the lack of getting better health information about ACBT and self-management guidance (Gaspar et al., 2019). The ACBT is one of the techniques breathing exercises which consists of three series of activities including breathing control exercises, thoracic expansion exercises (deep breathing), and forced expiration (huff) which aims to help remove sputum from the lungs (Athawale et al., 2020). Giving ACBT to patients can restore physical condition, improve breathing patterns, and break the chain of complaints (Huriah & Ningtias, 2017). The ACBT technique has been proven to be able to overcome problems related to airway cleanliness resulting in an increase in functional respiratory capacity, namely reducing shortness of breath and reducing sputum retention in the airway with measurement parameters using borg scale (Arifin, 2022). The low impact of implementing ACBT on respiratory problems can trigger the risk of worsening conditions in patients with respiratory problems (Zuriati et al., 2020).

One solution to overcome health problems is by using complementary therapy, namely manipulative and body-based therapy, such as relaxation of the respiratory system, which has benefits for

the body, including getting a feeling of calm and comfort, can relax muscles to reduce tension and boredom, reduce stress, and has a positive effect. distraction (Setyoadi & Kushariyadi, 2011). Distress conditions in a person can be treated with respiratory therapy (Kushariyadi et al., 2019). Increasing the ability of nurses to take a patient-centered approach and self-management of chronic respiratory diseases so that they can overcome airway clearance problems (Gaspar et al., 2019).

2. METHODS

The research aims to determine the effectiveness of providing ACBT to overcome the nursing problem of ineffective airway clearance in nursing care.

Design and Sample

The type of research is a case study using the nursing care method. The samples in the study were patients treated in the Catleya room at Dr. Soebandi Jember Hospital with the nursing problem of ineffective airway clearance. The way to obtain data sources in research is from

primary data by carrying out actions, observations and interviews with patients and families, while obtaining secondary data is through patient medical record data.

Variable and Analysis

The research variable is ACBT and nursing problems of ineffective airway clearance. Analysis in research uses the nursing care process which consists of nursing assessment, nursing diagnosis, nursing intervention, nursing implementation and nursing evaluation.

Setting and Strategy

Providing nursing intervention in the form of ACBT 2 times a day for 4 days, namely 7-10 February 2023. The therapy is given in the morning and afternoon with a therapy administration time of 15-20 minutes. Providing nursing interventions through the nursing process by teaching patients and families directly the techniques for implementing ACBT therapy properly and correctly according to the patient's condition. Providing intervention through the following stages:

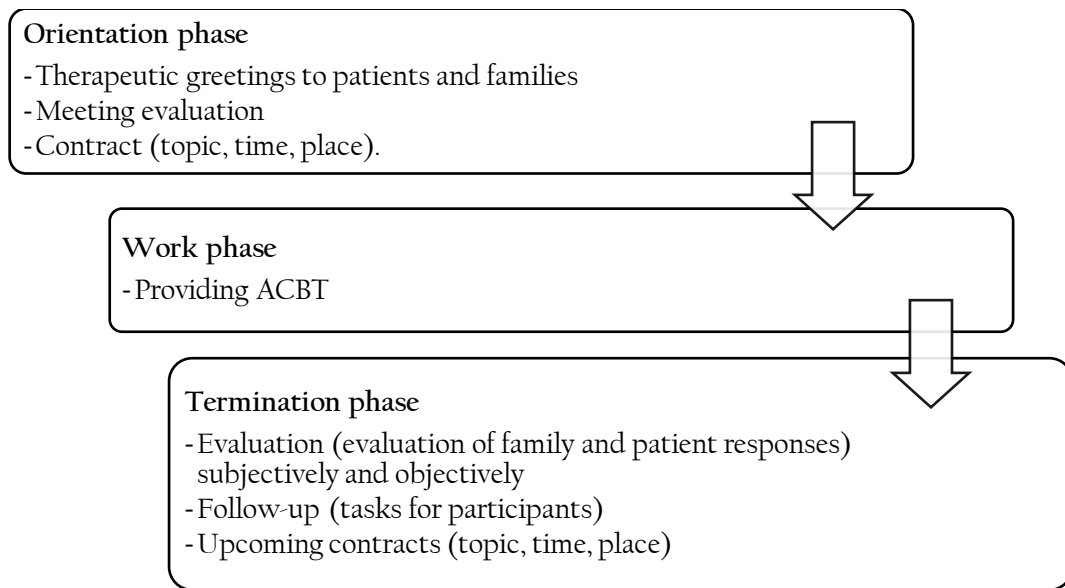


Figure 1. Stage of Active Cycle of Breathing Technique

3. RESULTS

Characteristics

Table 1. Characteristics of respondents

Characteristics	Information
Medical diagnosis	Tuberculosis Sequel
Age	65 years old
Gender	Male
Religion	Islam
Education	First Secondary School
Work	Farmer
Marital status	Marry

Nursing Care

Table 3. Nursing Care (Continue to page 94)

Nursing Process	Result
Nursing assessment	<p>Patients complain of shortness of breath and difficulty expelling phlegm.</p> <p>Focus on physical assessment:</p> <ul style="list-style-type: none"> - Neck, on inspection: there is use of the accessory muscles for breathing, namely the sternocleidomastoid muscle. - Chest, on inspection: chest shaped like a pigeon chest, tachypnea, chest asymmetry, sternum looks more protruding forward, difficulty in inhalation, expiratory frequency is prolonged. On palpation: there is tenderness in the chest area. Percussion: there is a dull sound in the chest. On auscultation: there are additional sounds rhonchi in the right and left lungs. - Supporting examination: chest x-ray results show non-enlarged casts and a picture of active pulmonary TB.

Nursing Process	Result
Nursing Diagnosis (PPNI, 2017)	Ineffective airway clearance associated with sputum hypersecretion marked by excessive sputum production, dyspnea, ineffective cough, orthopnea, tachypnea, respiratory rate 28 times per minute, additional breath sounds, rhonchi.
Nursing intervention (PPNI, 2018)	<p>Observation:</p> <ol style="list-style-type: none"> 1. Identify indications for breathing exercises. 2. Monitor the frequency, rhythm and depth of breathing before and after exercise. 3. Check for contraindications (e.g. patients who are unable to breathe spontaneously, patients who are unconscious, and patients who are unable to follow instructions). <p>Therapeutic:</p> <ol style="list-style-type: none"> 4. Get ACBT. <p>Education:</p> <ol style="list-style-type: none"> 5. Explain the things you need to pay attention to in the therapy. <p>Collaboration:</p> <ol style="list-style-type: none"> 6. Collaboration with a certified therapist.
Implementation of nursing	<ol style="list-style-type: none"> 1) Perform ACBT therapy twice a day (morning and evening) with a frequency of 15-20 minutes. The first therapy implementation was carried out in the morning and the second implementation was carried out in the afternoon (Endria et al., 2022). The second ACBT therapy was administered within 6 hours of the first ACBT therapy (Üzmezoğlu et al., 2018). Each ACBT therapy administration consists of 3 cycles (Lewis et al., 2012). 2) In the literature and in clinical settings, there is variation in the definition and application of ACBT therapy which contains three important components: 1) respiratory control; 2) forced expiratory technique (includes relaxation or control of breathing, and gasping, and includes postural drainage and percussion); 3) thoracic expansion exercises (include postural drainage or percussion) (Lewis et al., 2012). 3) The patient performs the steps breathing control by inhaling through the nose and exhaling slowly through the mouth for 3-4 times (Blomquist et al., 1986). 4) The patient performs the steps forced expiration technique by relaxation or control of breathing, and huffing, and includes postural drainage and percussion (Lewis et al., 2012). 5) The patient performs the steps thoracic expansion exercise by postural drainage or percussion (Lewis et al., 2012).

Nursing Evaluation

Table 3. Day 1 Nursing Evaluation

No	Indicator	Scale before ACBT therapy					Scale after 2 times ACBT therapy				
		1	2	3	4	5	1	2	3	4	5
1	Sputum production		✓					✓			
2	Ronchi		✓					✓			
3	Dyspnea		✓							✓	
4	Respiratory frequency		✓							✓	
5	Breathing pattern		✓							✓	
6	Orthopnea		✓					✓			
7	Effective Cough		✓							✓	

Table 3 shows the results of the evaluation on the first day, February 7 2023, namely the patient's complaints of shortness of breath decreased, but the patient still felt short of breath when lying down, SPO₂=97% with nasal cannula 4 lpm, respiratory frequency 24 times per minute with fast and shallow breathing. In the first stage of implementing ACBT therapy, it showed that the patient still had difficulty coughing effectively and the

phlegm was still thick white in small amounts. Patients seem to become more comfortable after carrying out ACBT therapy. Apart from receiving ACBT therapy, patients also receive oxygenation and nebulizer therapy. Based on data on the first day, the provision of ACBT therapy showed that ineffective airway clearance had not been achieved (indicators 1, 2 and 6).

Table 4. Day 2 Nursing Evaluation

No	Indicator	Scale before ACBT therapy					Scale after 2 times ACBT therapy				
		1	2	3	4	5	1	2	3	4	5
1	Sputum production		✓						✓		
2	Ronchi		✓						✓		
3	Dyspnea			✓					✓		
4	Respiratory frequency			✓						✓	
5	Breathing pattern			✓						✓	
6	Orthopnea			✓						✓	
7	Effective Cough			✓						✓	

Table 4 shows the results of the evaluation on the second day, February 8 2023, namely the patient's complaints of shortness of breath decreased, even when lying down, SPO₂=97% without nasal cannula, respiratory frequency 20 times per minute with deep and long breaths. In the second stage of implementing ACBT therapy, it showed that the patient's ability to cough effectively began to increase and the amount of white, liquid phlegm was

greater than when carrying out ACBT therapy on the first day. Patients seem to become more comfortable after carrying out ACBT therapy. On the second day of ACBT therapy, the patient no longer received oxygenation therapy, but still received nebulizer therapy. Based on data on the second day, the provision of ACBT therapy showed that ineffective airway clearance had not been achieved (seen in indicators 1 and 2).

Table 5. Day 3 Nursing Evaluation

No	Indicator	Scale before ACBT therapy					Scale after 2 times ACBT therapy				
		1	2	3	4	5	1	2	3	4	5
1	Sputum production			✓						✓	
2	Ronchi			✓				✓			
3	Dyspnea			✓						✓	
4	Respiratory frequency				✓						✓
5	Breathing pattern				✓						✓
6	Orthopnea				✓					✓	
7	Effective Cough				✓					✓	

Table 5 shows the results of the evaluation on the third day, February 9 2023, namely the patient's complaints of shortness of breath decreased, even in a lying position, SPO2=98% without nasal cannula, respiratory frequency 20 times per minute with deep and long breathing. In the third stage, the implementation of ACBT therapy showed that the patient's ability to cough effectively increased and the amount of white, liquid phlegm was

greater than when carrying out ACBT therapy on the second day. The patient said he became much more comfortable after routinely doing ACBT therapy in the morning and evening. On the third day of therapy, the patient received ACBT therapy and nebulizer therapy. Based on data on the third day, ACBT therapy showed that the ineffectiveness of airway clearance was partially resolved.

Table 6. Day 4 Nursing Evaluation

No	Indicator	Scale before ACBT therapy					Scale after 2 times ACBT therapy				
		1	2	3	4	5	1	2	3	4	5
1	Sputum production				✓						✓
2	Ronchi			✓					✓		
3	Dyspnea				✓						✓
4	Respiratory frequency				✓						✓
5	Breathing pattern					✓					✓
6	Orthopnea				✓						✓
7	Effective Cough				✓						✓

Table 6 shows the results of the evaluation on the fourth day, February 10 2023, namely that the patient's complaints of shortness of breath were much reduced, even in a lying position, SPO2=99% without nasal cannula, respiratory

frequency 16 times per minute. In the fourth stage, the implementation of ACBT therapy showed that the patient's ability to cough effectively increased and the phlegm was white and liquid in small amounts. This means that a lot of phlegm is released

from the respiratory tract. The patient only received ACBT therapy, while nebulizer therapy was stopped. Based on data on the fourth day of ACBT therapy, the results showed that the ineffectiveness of airway clearance was resolved, marked by an improvement in indicators 1 to 7 after routine ACBT therapy.

4. DISCUSSIONS

In table 1, patients with a diagnosis of sequel tuberculosis have a previous medical history, namely that they had been diagnosed with pulmonary tuberculosis and were declared cured five years ago. The patient was an active smoker, but after contracting pulmonary tuberculosis the patient stopped smoking. However, returning to an unhealthy lifestyle, such as smoking, is one of the risks of recurrence of tuberculosis symptoms in patients.

The results of systematic review research and meta-analysis show that one of the problems in tuberculosis control programs is the recurrence of this disease. In several studies, smoking was reported as the most important risk factor. Of the 14 studies that met the inclusion criteria. The number of samples in the group with relapsed tuberculosis sufferers in 1988 was 855 (43%) smokers, and in the group with tuberculosis sufferers without recurrence there were 27,226 people with the number

of smokers being 7503 (27.56%). In 13 studies, the odds ratio of recurrence of tuberculosis was higher in smokers; this difference was statistically significant in 12 of them. Combining the results of these 14 studies, the odds ratio of recurrence of tuberculosis in smokers was 2.10 times higher, with a confidence interval of (95% CI: 1.69, 2.61) (Pourali et al., 2023).

The results of research in Pakistan show that age is a risk factor for extrapulmonary tuberculosis. A total of 1,163 children were diagnosed with TB, of which 157 (13.5%) suffered from extrapulmonary tuberculosis. Of these, 46 (29.3%) were aged 0-4 years, 53 (33.8%) were aged 5-9 years, and 58 (36.9%) were aged 10-14 years. In children with extrapulmonary tuberculosis, the most frequently reported locations were lymph nodes (113, 72.4%) and stomach (31, 19.9%). Weight loss was associated with an increased risk of extrapulmonary tuberculosis at ages 0-4 years (odds ratio: 2.80, 95% confidence interval: 1.05-7.47) and ages 10-14 years (odds ratio: 2.79, 95% confidence interval: 1.28-6.07), and the presence of cough is associated with a reduced risk of extrapulmonary tuberculosis (Dubois et al., 2022).

In table 2, the results of the assessment of the main complaints experienced by the patient were shortness

of breath and difficulty expelling excess accumulated phlegm. On physical examination, it was found that the sternocleidomastoid muscle assists breathing, chest shape pigeon chest, tachypnea, the chest is not symmetrical, the sternum looks more protruding forward, the patient has difficulty in inhaling, exhalation is prolonged for 5 seconds, tenderness is found in the chest area, the sound in the chest area is dull, sounds are heard rhonchi in the right and left lung fields. Previously the patient had received treatment at the community health center for three days, but because there was no improvement in the condition and the patient still felt short of breath, the patient was taken to Dr. Soebandi Jember Hospital. The results of this research study are in accordance with research which states that tuberculosis patients will experience shortness of breath, coughing is ineffective, spasms can be found in the muscles that help with breathing (sternocleidomastoid muscles) and there are rhonchi on segments apical and anterior bilateral upper lobes (Arifin, 2019). On inspection thorax A picture of active tuberculosis was found. This is in accordance with research which states that pulmonary tuberculosis results are obtained with bilateral pleural effusion in

tuberculosis patients (Atmanto & Maranatha, 2019).

There are several nursing problems that can arise in pulmonary tuberculosis patients, such as ineffective airway clearance, unbalanced nutrition that is less than the body's needs, and risk of impaired gas exchange (Doenges et al., 2010). The presence of bacterial infection due to pulmonary tuberculosis in the bronchial walls causes weakness in the walls of the muscular elements and their elasticity so that the speed of sputum discharge decreases and triggers stasis mucus. An inflammatory response from neutrophils, lymphocytes and macrophages can increase secretion mucus (Nugroho, 2020). There is a buildup in the bronchial area which causes ineffective airway clearance nursing problems (Endria et al., 2022).

Table 2 also explains the nursing implementation of ACBT therapy which is carried out twice a day with a frequency of 15-20 minutes for each time the therapy is given. The first therapy is carried out in the morning and the second is carried out in the afternoon (Endria et al., 2022). The second ACBT therapy was administered within 6 hours of the first ACBT therapy (Üzmezoglu et al., 2018). Each ACBT therapy administration consists of 3 cycles (Lewis et al., 2012). The implementation of this therapy was carried out independently

by the patient and family with the supervision of researchers.

Respiration monitoring in the study was carried out based on predetermined output indicators, such as shortness of breath and the amount of sputum measured using borg scale, peripheral capillary oxygen saturation (SpO₂) was measured using pulse oximetry (Arifin, 2019). The Borg scale is an instrument used in pulmonary rehabilitation programs to evaluate shortness of breath parameters before, during and after progressive exercise (Hanafiah et al., 2020).

In tables 3, 4, and 5, the nursing evaluation is from the first to the last day of ACBT therapy. This research shows that the application of ACBT intervention is effective in overcoming the problem of ineffective airway clearance nursing. This can be seen from an increase in functional respiratory capacity, namely a reduction in sputum retention in the airway and a reduction in patient shortness of breath with the measurement parameters borg scale.

The results of research conducted on COPD patients stated that the ACBT technique could significantly increase sputum production and respiratory function in COPD patients. Increasing the viscosity and production of sputum can be beneficial for chronic obstructive

pulmonary disease patients to eliminate inflammation and reduce the patient's symptoms of respiratory problems. The results of other research show that using a combination of ACBT therapy with other programs or technology can provide more benefits to patients (Shen et al., 2021). The results of other research showed that ACBT therapy was accompanied by administration postural drainage in bronchitis patients it is more effective in increasing daily sputum output, increasing oxygen levels in arteries, increasing PaO₂, minimizing P (A-1) compared to conventional therapy (Halim et al., 2016). The results of other research show that spiritual deep breathing therapy as a nursing modality can optimize oxygen needs in stressed cells, blood flow to the muscles decreases, whereas blood flow to the brain and skin increases, providing a feeling of warmth, comfort and calm (Kushariyadi et al., 2019). The results of other research conducted on bronchiectasis patients show that ACBT therapy is an effective airway clearance technique compared to other airway clearance techniques, and is a simple and inexpensive way to carry out this intervention. This therapy will help the process of mobilizing secretions. The ACBT technique helps in the redevelopment of lung tissue (Elsayed et

al., 2015). The nurse can recommend providing active cycle of breathing technique therapeutic nursing intervention to overcome the nursing problem of ineffective airway clearance.

5. CONCLUSIONS

The results of the assessment showed that the patient was 65 years old with a medical diagnosis sequelae tuberculosis, farmer work. The patient's main complaints are shortness of breath and difficulty expelling phlegm, using the accessory muscles for breathing, namely the muscles sternocleidomastoideus, chest shape pigeon chest, tachypnea, the chest is not symmetrical, the sternum looks more protruding forward, the patient has difficulty in inhaling, expiration is prolonged for 5 seconds, there is tenderness in the chest area, there is a dull sound in the chest, there are additional sounds rhonchi In the patient's right and left lung fields, there was a picture of active pulmonary tuberculosis on the examination results photo thorax with nursing problems of ineffective airway clearance. The patient received therapeutic nursing intervention active cycle of breathing technique with a dose of 2 times a day for 4 consecutive days with a frequency of 15-20 minutes consisting of 3 cycles. The results of the study showed that

providing therapy active cycle of breathing technique effective in reducing the nursing problem of ineffective airway clearance.

ACKNOWLEDGEMENT

Researchers would like to thank all parties who participated in this study, especially dr. Soebandi General Hospital Jember.

AUTHOR CONTRIBUTIONS

Substantial contributions to conception, data collection, and analysis: Kushariyadi, Sujarwanto, Alisa Qudrunanda Rosyida. Writing manuscript and revisions: Kushariyadi and Alisa Qudrunanda Rosyida.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy or ethical restrictions.

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