Journal Of Nursing Practice
https://thejnp.org/
ISSN: 2614-3488 (print); 2614-3496 (online) Vol.8 No.3. April 2025. Page.650-656

Combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy on the Effectiveness of Airborne Cleaning in Pulmonary TB Patients

Risti Puji Listari[1*], Eppy Setiyowati[2], Chilyatis Zahroh[3]
[1] *Kerta Cendekia Health Polytechnic Sidoarjo, Indonesia*
[2,3] *Faculty Nursing and Midwifery, Nahdlatul Ulama University Surabaya, Indonesia*
**Corresponding author: pujilistariristi@gmail.com*

ABSTRACT

Background: The occurrence of ineffective airway clearance in pulmonary TB patients begins with disease transmission which occurs when a patient with positive BTA sneezes or coughs without covering his nose or mouth so that germs will spread into the air in the form of phlegm or droplets. In the pathophysiology of pulmonary TB, it can cause destruction or fibrosis of the airways and damage the lung parenchyma, causing tracheal/pharyngeal edema, increased secretion production, sputum obstruction, rupture of blood vessels or even hemaptoea, resulting in the airway being ineffective and causing shortness of breath.
Purpose: The aim of this research isexplain the study aims to determine the effect of a combination of Active Cycle of Breathing Techniques (ACBT) and chest physiotherapy on the effectiveness of airway clearance in pulmonary TB patients.
Methods: The method used was quasi experimental with a pretest-posttest control group design approach. This design involved two groups, namely a combination intervention group of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy and a control group. Data collection was carried out using direct observation sheets and medical records.
Results: Based on the test results using Mann Whitney, a p value of 0.000 was obtained, where the value was <0.05, which means there was a difference in the airway clearance score between the intervention and control groups in the delta/change data, where based on the mean value, the airway clearance score for the intervention group was obtained. the increase in score was greater than the control group when delta/change data.
Conclusion: Combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy on the Effectiveness of Airway Clearing in Pulmonary TB Patients and is easy to do.

Keywords: Active Cycle of Breathing Techniques (ACBT), airway clearance, chest physiotherapy, pulmonary TB

Received February 10, 2025; Revised March 12, 2025; Accepted April 7, 2025
DOI: https://doi.org/10.30994/jnp.v8i3.567

BACKGROUND

The occurrence of ineffective airway clearance in pulmonary TB patients begins with disease transmission which occurs when a patient with positive BTA sneezes or coughs without covering his nose or mouth so that germs will spread into the air in the form of phlegm or droplets. In the pathophysiology of pulmonary TB, it can cause destruction or fibrosis of the airways and damage the lung parenchyma, causing tracheal/pharyngeal edema, increased secretion production, sputum obstruction, rupture of blood vessels or even hemaptoea, resulting in the airway being ineffective and causing shortness of breath(Ghazi et al., 2021). Discomfort in breathing is defined as shortness of breath or also called dyspnea. Shortness of breath felt by patients generally feels like suffocation, suffocation, gasping, and feels heavy when breathing, which is characterized by visible accessory muscles for breathing, nostrils, inadequate oxygen saturation and wheezing or rhonchi appear (Yin et al., 2022). Nursing problems that can generally be raised in this case are ineffective airway clearance, ineffective breathing patterns, and gas exchange disorders(Song et al., 2023). Therefore, shortness of breath management is needed to return the patient's condition to normal by minimizing complaints (Komrakova et al., 2019). This can be prevented by giving a combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy, but in reality the combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy has not been carried out.(Telford et al., 2020).

Pulmonary Tuberculosis (Pulmonary TB) according to the World Health Organization (WHO) is one of the 10 main causes of death worldwide. In 2017, it is known that 10 million people fell ill with pulmonary TB and 1.6 million died from pulmonary TB. More than 95% of cases and deaths due to pulmonary TB occur in developing countries, the largest number of new pulmonary TB cases occur in the Southeast Asia and West Pacific regions, with 62% of new cases, followed by the African region, with 25 % of new cases. The eight countries with the highest cases are India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh and South Africa (Boggild et al., 2019). Based on the 2013-2014 Pulmonary TB Prevalence Survey, the prevalence of pulmonary TB with bacteriological confirmation in Indonesia was 759 per 100,000 population aged 15 years and over with a prevalence of BTA Positive Pulmonary TB of 252 per 100,000 population aged 15 years and over. According to 2 Indonesian Ministry of Health Information Data Centers in 2018, the number of new cases of pulmonary TB in Indonesia was 420,994 cases in 2017. Based on the results of the 2018 Riskesdas prevalence survey, the highest cases of tuberculosis were in the provinces of Papua (0.77%), Banten (0.76%), and West Java (0.63%), while of the 34 provinces in Indonesia, Bali has the lowest ranking at number 2, namely 0.13% after Bangka Belitung (Chu et al., 2022)

Pulmonary TB disease is transmitted through airborne means, namely inhalation of droplets containing Mycobacterium tuberculosis bacteria. Pulmonary TB patients will complain of a cough accompanied by phlegm and/or coughing up blood, shortness of breath, pain in the chest area, night sweats, decreased appetite. Physical examination shows signs of increased respiratory frequency, irregular breathing rhythm, and rhonchi. Referring to these manifestations, a common nursing problem that occurs in pulmonary TB patients is ineffective airway clearance (Chow et al., 2020). Ineffective airway clearance is the inability to clear secretions or airway obstruction to maintain a patent airway (Raval et al., 2018).Improper phlegm expulsion due to ineffective airway clearance means that sufferers experience difficulty breathing and gas exchange disorders in the lungs which results in cyanosis, fatigue, apathy and feeling weak. In the next stage, the airway will narrow,

resulting in airway adhesions and airway obstruction. For this reason, help is needed to expel sticky phlegm so that the airway can be cleared again effectively(Adaikina et al., 2022).

Ineffective airway clearance can be overcome with pharmacological and non-pharmacological interventions. Non-pharmacological management as a form of nursing intervention in overcoming ineffective airway clearance problems is by administering Active Cycle of Breathing Technique (ACBT) (Cochrane et al., 2020). The second non-pharmacological management as a form of nursing intervention in overcoming the problem of ineffective airway clearance is by providing chest physiotherapy. Providing chest physiotherapy can remove secretions from the small and large airways so that the secretions can be expelled. The research results of Egeria Dorina Sitorus, Rosita Magdalena Lubis, Eni Kristen (2018) stated. The results of the case study showed an increase in secretion output in clients with pulmonary TB who received effective cough therapy and chest physiotherapy, so that clients were able to maintain an effective airway. According to (Mardianti et al., 2022) stated that there was a difference in the influence of breathing patterns before and after giving active cycle of breathing technique (ACBT) therapy on improving the respiratory frequency of pulmonary tuberculosis patients with a significant value of 0.000 < 0.005.

OBJECTIVE

The aim states the main aim of the researchExplainThis study aims to determine the effect of a combination of Active Cycle of Breathing Techniques (ACBT) and chest physiotherapy on the effectiveness of airway clearance in pulmonary TB patients.

METHODS

Quantitative research uses a quasi-experimental method with a preposttest control group design. Independent variableActive Cycle Of Breathing Techniques (ACBT) And Chest Physiotherapy anddependent variable: Effectiveness of Road Cleaning using airway clearance score. The sampling technique used in this research was purposive sampling. The number of respondents was 40 people. This research was conducted at RSI Siti Hajar Sidoarjo, Indonesia. The research was carried out in January 2024 - February 2024. Before carrying out this research, an ethical review of the protocol had been carried out and it was declared ethically appropriate with number 0023/016/EC/KEP/LCBL/2024. Statistical tests of research results are used Mann Whitney and Wilcoxon test.

RESULTS

The research results obtained by researchers are as follows:

Table 1. Frequency distribution of characteristics of respondents who experienced airway clearance

Subject Characteristics	Group		Total (40)	Equality p value
	Treatments (n=20)	Controls (n=20)		
Gender				
Man	8 (40.0%)	10 (50.0%)	18 (45.0%)	0.751a
Woman	12 (60.0%)	10 (50.0%)	22 (55.0%)	
Age				
Range (Median)	22 - 66 (49.50)	35 - 52 (44.50)	22 - 66 (47.50)	0.061b
Mean ± SD	48.10 ± 10.07	43.65 ± 6.02	45.88 ± 8.49	

Subject Characteristics	Group		Total (40)	Equality p value
	Treatments (n=20)	Controls (n=20)		
20-29 Years	1 (5.0%)	0 (0%)	1 (2.5%)	
30-39 Years	3 (15.0%)	8 (40.0%)	11 (27.5%)	
40-49 Years	6 (30.0%)	7 (35.0%)	13 (32.5%)	
50-60 Years	9 (45.0%)	5 (25.0%)	14 (35.0%)	
≥60 Years	1 (5.0%)	0 (0%)	1 (2.5%)	
Education				
Junior High School	4 (20.0%)	6 (30.0%)	10 (25.0%)	0.631b
Senior High School	12 (60.0%)	10 (50.0%)	22 (55.0%)	
Bachelor	4 (20.0%)	4 (20.0%)	8 (20.0%)	
Work				
Farmer	5 (25.0%)	6 (30.0%)	22 (27.5%)	0.563a
Private	13 (65.0%)	10 (50.0%)	23 (57.5%)	
Civil servants	2 (10.0%)	4 (20.0%)	6 (15.0%)	

Based on table 1, it is known that in the intervention and control groups there were 8 male subjects with a percentage of 40%, while there were 12 female subjects with a percentage of 60%. The age of respondents who experienced airway clearance was mostly 50-60 years old in the intervention group (45.0%) and the control group was mostly 30-39 years old (40.0%). Education of respondents who experienced airway clearance. Most of them had high school education in the intervention group (60.0%) and control group (50.0%). The occupation of respondents who experienced airway clearance was mostly private in the intervention group (65.0%) and mostly farmers in the control group (30.0%).

Table 2. Identification results of airway clearance analysis data before and after giving a combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy

Variables	Group	Pre-test	Post test	Delta	*p-value*
		Mean ± SD	Mean ± SD	Mean ± SD	
Airway Clearance Score	Treatment	0.30 ± 0.47	7.45 ± 0.51	7.15 ± 0.67	0,000b
	Controls	0.50 ± 0.51	6.55 ± 0.99	6.05 ± 0.83	0,000b
	p-value	0.202a	0.003a	0.000a	

Based on the airway clearance score test, table 2. above explains that the airway clearance score between the treatment and control groups was analyzed using the Mann Whitney statistical test, obtaining ap value of 0.000, where the value is <0.05, so there is a significant difference between the airway clearance scores. Pretest and post-test data were recorded in the control group and intervention group. The average airway clearance score after observation in the control group was that patients said there was an improvement in complaints on the 3rd day, such as less shortness of breath, no wheezing, less frequent coughing. Based on the mean value, it was found that the treatment group's airway clearance score increased in score greater than that of the control group when the Delta/change data occurred.

DISCUSSION

Mengidentify airway clearance in pulmonary TB patients before and after the combination procedure of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy

Based on the research results in table 2. it explains that in the positive rank there are respondents who have posttest scores higher than the pretest scores, in the positive rank there are 20 respondents in the control group and 20 respondents in the intervention group with posttest scores higher than the pretest. The airway clearance scores in the control group and intervention group were analyzed using the Mann Whitney statistical test, obtaining ap value of 0.000, where this value was <0.05, so there was a significant difference between the gastroesophageal reflux scores recorded at pretest and posttest in the control group and intervention group.

Tuberculosis or commonly known as TB is a disease that has existed for thousands of years and is still a major health problem in the world. TB is an infectious disease caused by the bacteria Mycobacterium tuberculosis which generally attacks the lungs but can also affect other body organs (Janan, 2019). Management strategies for Active Cycle of Breathing Technique (ACBT) and Chest Physiotherapy for pulmonary TB sufferers can be carried out by administering pharmacological therapy/drugs or non-pharmacological interventions.

Based on research by Rusna Tahir (2019), it shows that the influence of chest physiotherapy and coughing is effective as a management of ineffectiveness.
airway clearance in pulmonary TB patients. This is in line with the results of research conducted by Eka Nugraha (2021) which shows the effect of Active Cycle of Breathing Technique (ACBT) therapy on respiratory frequency.

According to Muchtar, there is actually no clear theory about the reason for the high prevalence of TB in men, but it may be because men have more activity outside so they are more at risk of being exposed to TB germs. This is also reinforced by the fact that men have more smoking habits. (Muchtar et al, 2018). Based on the research results in table 5.1, almost all of the respondents who experienced airway clearance at RSI Siti Hajar Sidoarjo were female, 22 people, 12 people in the intervention group and 10 people in the control group. Based on age, the majority of respondents who experienced airway clearance (45%) were 9 people aged 50 - 60 years and 8 people aged 30-39 years (40%), 8 people in the control group and 9 people in the intervention group .

One of the new therapies used to overcome ineffective airway clearance is Active Cycle Of Breathing Techniques (ACBT) and Chest Physiotherapy. ACBT is an exercise that consists of three cycles, namely respiratory relaxation, thoracic expansion exercises and active secretion removal, namely using forced exhalation (huffing) techniques (Pakpahan, 2018). Chest physiotherapy is a procedure, namely percussion, vibration and postural, which is very important for clearing and improving the smoothness of the airway in patients with airway disorders. This therapy requires a lot of patient education regarding this therapy. A person's low knowledge about Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy can be an obstacle so that families don't want to do this because they don't know the method and benefits and are afraid that something will go wrong. The lack of knowledge of patients and families has been intervened by nurses by providing health education.

However, whatever nurses do to increase knowledge if they do not get a positive response will not produce optimal results (Mufida, 2019). Based on education level, 22 respondents experienced the effectiveness of respiratory aid cleaning at RSI Siti Hajar Sidoarjo at high school level, 12 people in the treatment group and 10 people in the control

group. If airway clearance is not effective if not treated immediately it can cause a lack of oxygen in the body's cells. Lack of oxygen in the body's cells will hinder the supply of oxygen to the brain and tissues throughout the body. If lack of oxygen is left for a long period of time it can result in permanent brain cell damage, loss of consciousness and even death (Widodo & Pusporatri, 2020).

Ineffective airway clearance can be overcome with pharmacological and non-pharmacological interventions. Pharmacological intervention can be carried out by administering antibiotics, bronchodilators and oxygen administration. This pharmacological intervention is usually obtained in hospitals, however if the patient experiences shortness of breath at home oxygen and medication are not always available at home (Suryati et al., 2018).

ACBT and chest physiotherapy have been found to be associated with airway clearance. In a broad sense, ACBT and chest physiotherapy are mainly used to clear the airway.

Analysis of the combination of Active Cycle Of Breathing Techniques (ACBT) and Chest Physiotherapybefore and after treatment

Based on the research results in table 2, it explains that between the treatment and control groups using the Mann Whitney test, ap value of 0.000 was obtained, where this value was <0.05, so there was a significant difference between the control group posttest data and the intervention group posttest data on airway clearance scores, so that there is an influence of the combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy on the effectiveness of providing an airway at RSI Siti Hajar Sidoarjo.

Providing therapy to patients is a task and requirement, and plays a central role in therapeutic strategies, one of which is the Active Cycle of Breathing Techniques (ACBT). ACBT is an exercise that consists of three cycles, namely respiratory relaxation, thoracic expansion exercises and active secretion removal, namely using forced exhalation (huffing) techniques (Pakpahan, 2018).

The way to clear the airway is with chest physiotherapy. Chest physiotherapy is a procedure, namely percussion, vibration and postural, which is very important for clearing and improving the smoothness of the airway in patients with airway disorders.

CONCLUSION

1. There was a significant difference between the control group and the intervention before and after administering a combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy on the Effectiveness of Airway Clearing in Pulmonary TB Patients, where the delta value obtained was a greater increase in the intervention group's score. compared to the control group.
2. There is an influence of the combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy on the Effectiveness of Airway Clearing in Pulmonary TB Patients.

ACKNOWLEDGMENTS

The research team would like to thank everyone after clearing the airway of pulmonary TB patients respondents and Siti Hajar Islamic Hospital Sidoarjo, Indonesia for granting research location permits.

CONFLICT OF INTEREST

In this study, from start to finish there was no conflict.

REFERENCES

Adaikina, A., Derraik, J. G. B., Power, L. C., Grady, G. O., Munns, C. F., Hofman, P. L., & Gusso, S. (2022). Feasibility, safety, and efficacy of 12-week side-to-side vibration therapy in children and adolescents with congenital myopathy in New Zealand. *Neuromuscular Disorders*, *32*(10), 820–828. https://doi.org/10.1016/j.nmd.2022.07.398.

Boggild, M. K., Tomlinson, G., Erlandson, M. C., Szabo, E., Giangregorio, L. M., Craven, B. C., Slatkovska, L., Alibhai, S. M. H., & Cheung, A. M. (2019). Effects of Whole-Body Vibration Therapy on Distal Tibial Myotendinous Density and Volume: A Randomized Controlled Trial in Postmenopausal Women. *JBMR Plus*, *3*(5), 1–8. https://doi.org/10.1002/jbm4.10120.

Chow, S. K. H., Chim, Y. N., Cheng, K. Y. K., Ho, C. Y., Ho, W. T., Cheng, K. C. C., Wong, R. M. Y., & Cheung, W. H. (2020). Elastic-band resistance exercise or vibration treatment in combination with hydroxymethylbutyrate (HMB) supplement for management of sarcopenia in older people: A study protocol for a single-blinded randomised controlled trial in Hong Kong. *BMJ Open*, *10*(6), 1–7. https://doi.org/10.1136/bmjopen-2019-034921.

Chu, Y., Wang, Q., Chu, M., Geng, B., Jia, H., Li, X., Lv, T., & Jiang, S. (2022). Long-Term Effect of Vibration Therapy for Training-Induced Muscle Fatigue in Elite Athletes. *International Journal of Environmental Research and Public Health*, *19*(12). https://doi.org/10.3390/ijerph19127531.

Cochrane, D. J., Cochrane, F., & Roake, J. A. (2020). An exploratory study of vibration therapy on muscle function in patients with peripheral artery disease. *Journal of Vascular Surgery*, *71*(4), 1340–1345. https://doi.org/10.1016/j.jvs.2019.06.214.

Ghazi, M., Rippetoe, J., Chandrashekhar, R., & Wang, H. (2021). Focal vibration therapy: Vibration parameters of effective wearable devices. *Applied Sciences (Switzerland)*, *11*(7). https://doi.org/10.3390/app11072969.

Komrakova, M., Rechholtz, C., Pohlmann, N., Lehmann, W., Schilling, A. F., Wigger, R., Sehmisch, S., & Hoffmann, D. B. (2019). Effect of alendronate or 8-prenylnaringenin applied as a single therapy or in combination with vibration on muscle structure and bone healing in ovariectomized rats. *Bone Reports*, *11*(December 2018), 100224. https://doi.org/10.1016/j.bonr.2019.100224.

Mardianti, T., Sartika, M., Studi Sarjana Keperawatan, P., & Ilmu Kesehatan, F. (2022). *PENGARUH TERAPI ACTIVE CYCLE BREATHINGTECHNIQUE*.

Raval, A. P., Schatz, M., Bhattacharya, P., D'adesky, N., Rundek, T., Dietrich, W. D., & Bramlett, H. M. (2018). Whole body vibration therapy after ischemia reduces brain damage in reproductively senescent female rats. *International Journal of Molecular Sciences*, *19*(9). https://doi.org/10.3390/ijms19092749.

Song, X., Sassi, A., Seaman, K., Lin, C.-Y., & You, L. (2023). Vibration Therapy for Cancer-Related Bone Diseases. *Vibration*, *6*(2), 449–465. https://doi.org/10.3390/vibration6020028.

Telford, D., Vesey, R. M., Hofman, P. L., & Gusso, S. (2020). The Effect of Vibration Therapy on Walking Endurance in Children and Young People With Cerebral Palsy: Do Age and Gross Motor Function Classification System Matter? *Archives of Rehabilitation Research and Clinical Translation*, *2*(3), 100068. https://doi.org/10.1016/j.arrct.2020.100068.

Yin, L., An, Y., Chen, X., Yan, H. xin, Zhang, T., Lu, X. gang, & Yan, J. tao. (2022). Local vibration therapy promotes the recovery of nerve function in rats with sciatic nerve injury. *Journal of Integrative Medicine*, *20*(3), 265–273. https://doi.org/10.1016/j.joim.2022.02.001.