Description Of The Effectiveness Of Active Cycle Of Breathing Technique (ACBT) Therapy On Airway Clearance In Patients With Pulmonary Tuberculosis: A Literature Review

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ABSTRACT

Pulmonary tuberculosis (TB) is a chronic disease that often causes serious respiratory complications such as excessive mucus buildup and decreased lung function, necessitating rehabilitation interventions to improve patients' quality of life. ACBT is a respiratory rehabilitation technique involving a series of active breathing exercises aimed at clearing the airways and improving lung function. A literature review of six studies encompassing various research designs, including quasi-experimental, pre-experimental, randomised controlled trials (RCTs), and case studies, found empirical evidence that ACBT is effective in clearing the airways, improving breathing patterns, and improving lung function parameters such as forced expiratory volume in one second (FEV1) and peak expiratory flow (PEF). Furthermore, this technique has also been shown to reduce respiratory symptoms such as shortness of breath and sputum production. ACBT is considered a safe intervention and can be integrated into pulmonary TB rehabilitation protocols to improve functional outcomes and patient quality of life. However, further research with larger sample sizes and more rigorous methodology is needed to strengthen the evidence for ACBT's effectiveness and address methodological variations in previous studies. This follow-up research is crucial to ensure optimal implementation of ACBT in the clinical practice of pulmonary TB rehabilitation.

Keywords: Active cycle breathing technique, pulmonary tuberculosis, airway clearance

INTRODUCTION

Pulmonary tuberculosis is a chronic infection caused by the bacterium Mycobacterium tuberculosis. This disease often causes problems with the respiratory system, such as the accumulation of mucus secretions in the airways. This can lead to airway obstruction, decreased lung function, and the risk of complications such as pneumonia or respiratory failure. In patients with pulmonary TB, effective airway clearance is crucial to prevent the spread of infection and accelerate recovery [1].

According to WHO data, the estimated number of people diagnosed with TB in 2021 worldwide was 10.6 million cases, an increase of approximately 600,000 cases from 2020, which had an estimated 10 million TB cases. Of these 10.6 million cases, 6.4 million (60.3%) have been reported and are undergoing treatment, while the remaining 4.2 million (39.7%) have not been found/diagnosed and reported [2].

Geographically, the highest number of TB cases are in Southeast Asia (45.6%), followed by Africa (23.3%) and the Western Pacific (17.8%). The lowest numbers are in the Eastern Mediterranean (8.1%), the Americas (2.9%), and Europe (2.2%). Ten countries account for two-thirds of the total TB cases: India (27.9%), Indonesia (9.2%), China (7.4%), the Philippines (7.0%), Pakistan (5.8%), Nigeria (4.4%), Bangladesh (3.6%), the Democratic Republic of the Congo (2.9%), South Africa (2.9%), and Myanmar (1.8%) [3].

Indonesia is in second place with the highest number of TB cases in the world after India, followed by China, the Philippines, Pakistan, Nigeria, Bangladesh, and the Democratic Republic of Congo in that order. In 2020, Indonesia ranked third in case burden, so 2021 will clearly be bad. It is estimated that there are 969,000 cases of tuberculosis (one person every 33 seconds) in Indonesia. This figure is a 17% increase from 2020, which had 824,000 cases. The incidence of tuberculosis cases in Indonesia is 354 per 100,000 population, meaning that out of every 100,000 people in Indonesia, 354 of them have tuberculosis [4].

Pulmonary tuberculosis (TB) is a major global health problem, with high morbidity and mortality rates, especially in developing countries like Indonesia. One of the frequent complications experienced by patients with pulmonary tuberculosis is ineffective airway clearance, characterised by ineffective coughing, sputum buildup, shortness of breath, and additional breath sounds such as wheezes. This condition can lead to airway obstruction, reduced lung functional capacity, and a decline in the patient's quality of life [5].

Airway clearance management efforts are ineffective in TB patients; in addition to pharmacological therapy, non-pharmacological interventions, such as breathing exercises, are also needed. One recommended technique is the Active Cycle of Breathing Technique (ACBT), which consists of a series of controlled breathing exercises, chest expansion, and forced expiratory techniques to help mobilise and clear secretions {Citation}. {Citation}Various studies show that applying ACBT can improve airway clearance, reduce the degree of breathlessness, improve lung function, and increase physical activity capacity in patients with pulmonary TB [6].

Active Cycle Breathing Technique (ACBT) is a breathing exercise technique that includes breath control cycles, thoracic expansion exercises, and forced expiration techniques to control breathing to produce a calm and rhythmic breathing pattern that maintains the performance of the respiratory muscles and stimulates the

release of sputum to open the airways in patients with various respiratory diseases. The stages in ACBT are to regulate breathing patterns and what differentiates this method from other methods is the final stage using forced expiration techniques or huffing, which are effective in reducing obstruction in the airways [7]. The ACBT technique is an effective technique for clearing the airway. The ACBT cycle consists of breathing control, three to four chest expansion exercises, and forced expiratory technique (huffing) [8]. The Active Cycle of Breathing Technique has been proven to improve short-term secretion clearance in patients with chronic lung disease.

This therapy is well-tolerated and accepted by patients. Although ACBT is widely used in patients with respiratory conditions characterised by chronic sputum production, such as cystic fibrosis and bronchiectasis, recent literature on perioperative chest physiotherapy involving ACBT after thoracic surgery is still limited [9]. A quasi-experimental study found that ACBT can improve secretion clearance and functional exercise capacity for lung cancer patients after lobectomy, but it did not significantly reduce PPC [10]. Applying the Active Cycle of Breathing Technique (ACBT) trains tidal-volume breathing, which can reduce shortness of breath. This can help relax the respiratory tract and alleviate symptoms of shortness of breath, chest tightness, and anxiety [11].

However, knowledge and application of this technique in the community are still limited, so many pulmonary TB patients have not yet received optimal benefit from ACBT interventions. Therefore, research on the effectiveness of ACBT in addressing ineffective airway clearance among patients with pulmonary TB is crucial to support rehabilitation efforts and improve patients' quality of life.

MATERIAL AND METHOD

This article discusses strategies for finding journals used in literature reviews. The strategy used to search for articles is the PICOS Framework, which includes Population (pulmonary tuberculosis patients), Intervention (Active Cycle of Breathing Technique or ACBT), Comparison (standard treatment without ACBT or control group), Outcome (airway clearance, lung function, breathing pattern, and respiratory symptoms), and Study design (quasi-experimental, pre-experimental, RCT, or case study). The search for articles and journals was conducted using keywords and Boolean operators (AND, OR, NOT, and NOT AND) to broaden or narrow the search, making it easier to identify the articles and journals used in this study. The keywords

used in the search for articles and journals were "Active Cycle Breathing Technique" AND "Pulmonary Tuberculosis" OR "Airway Clearance" AND "TB Patients". The data used in this literature review were secondary data obtained from previous studies. The secondary data sources obtained were journals and articles relevant to the topic, which were searched using databases thru Google Scholar and PubMed.

Based on the results of the literature search thru Google Scholar and PubMed using English keywords, namely "Active Cycle Breathing Technique" AND "Pulmonary Tuberculosis" OR "Airway Clearance" AND "TB Patients". Meanwhile, in Indonesian, the literature search through Google Scholar using the keywords "Teknik Pernapasan Siklus Aktif" AND "Tuberkulosis Paru" OR "Bersihan Jalan Napas" AND "Pasien TB". Researchers identified 67 journals, which were then narrowed to the last 5 years, resulting in 57 journals. These were further selected for relevance to the topic, resulting in 15 journals. Finally, based on the abstracts, 6 relevant journals were identified. The final number of journals analysed, based on the research problem and objectives, was 9. This review was conducted through a narrative analysis of the six articles provided, without external searches. Inclusion criteria are articles that focus on ACBT for patients with pulmonary TB, with clear study designs and empirical data on its effectiveness.

RESULTS AND DISCUSSION

Data was manually extracted from article summary tables, including titles, population/sample, objectives, methods, results, measured variables, and key findings. Analysis involved comparing findings across articles to identify patterns of consistency, methodological strengths, and clinical implications. The research designs in the articles include quasi-experimental, pre-experimental, and case studies, with sample sizes ranging from 1 to 40 patients (Article 1: 10 patients; Article 2: 17 patients; Article 3: 20 patients; Article 4: 40 patients; Article 5: 2 patients; Article 6: 1 patient). The duration of ACBT intervention ranges from 3 to 7 days, with pretest-posttest measurements or group comparisons. Descriptive and inferential statistics are used in most articles, such as t-tests or p-values, to assess significance (Article 1: $p=0.004$; Article 2: $p=0.00$; Article 3: $p<0.05$).

Table 1. Research Results on the Effectiveness of Active Breathing Cycle Technique (ACTB) Therapy on Airway Clearance in Patients with Pulmonary Tuberculosis

No	Title	Population/ Sample	Objective	Method	Results	
					What is Measured	Findings
1	Active Cycle Breathing Technique on Airway Clearance in Pulmonary TB Patients. Vol. 6, No. 2, July 2024	10	To determine the effect of ACBT on airway clearance in Tuberculosis patients. Published.	Quasi-experiment One Group Pre-test Post-test	Airway clearance	After being given the active cycle breathing technique, airway clearance became effective with a p-value of 0.004, which is less than (α=0.05), indicating that ACBT has an effect on airway clearance
2	The Effect Of Giving *Active Cycle Of Therapy Breathing Technique* (ACBT) On Respiratory Rate In Pulmonary Tuberculosis Patients At arifin achmad hospital Riau Province	17	To determine the effect of active cycle of breathing technique (ACBT) therapy on improving breathing patterns in patients with pulmonary tuberculosis.	Pre-experimental with a one-group pre-test and post-test design.	Breathing patterns, respiratory rate.	There is an effect of ACBT therapy on improving breathing patterns in patients with pulmonary tuberculosis with p=0.00.
3	Combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy on the Effectiveness of Airborne Cleaning in	2 groups consisting of 8 men and 12 women	explained the effect of combining Active Cycle of Breathing Techniques (ACBT) and chest physiotherapy on the effectiveness of airway	quasi-experimental with a pretest-posttest control	Improvement in symptoms on day 3, such as reduced shortness of breath, no wheezin	A value of < 0.05 was obtained, which means there is a difference in airway clearance scores between the intervention and control groups for the delta/change

	Pulmonary TB Patients. Vol.8 No.3. April 2025. Page.650-656		clearance in pulmonary TB patients.	group design approach.	g, and decreased coughing.	data. Based on the mean values, the intervention group had a higher airway clearance score.
4	Effects of Active Cycle of Breathing Techniques on Pulmonary Function, Sputum Clearance, Chest Expansion, and Exercise Capacity in Tuberculosis Patients. Volume III, Issue IV	A total of 40 patients were randomly divided into a control group (n = 20).	Effect of ACBT on lung function, sputum clearance, chest expansion, exercise capacity	RCT, control vs intervention	ACBT improves lung function (FEV1, PEF), sputum clearance, chest expansion, and exercise capacity, with a decrease in BCSS score.	Integrating ACBT with standard anti-TB treatment significantly improves lung function, chest mobility, airway clearance, and symptom burden, supporting its clinical application into tuberculosis rehabilitation protocols to enhance functional outcomes and patients' quality of life.
5	Penerapan Teknik Active Cycle of Breathing Technique (ACBT) dalam Mengatasi Penumpukan Sekret pada Penderita Tuberculosis Paru. Vol. 3 No. 4	A sample of 2 people	Applying the ACBT technique to remove retained secretions in patients with Pulmonary Tuberculosis in the Working Area of Penfui Health Center, Kupang City, East	Case Study	Application of ACBT exercises to patients for 3 days, with sputum production on the 3rd day.	ACBT is effective in removing retained secretions, addressing the nursing problem of ineffective airway clearance.

			Nusa Tenggara.			
6	Penerapan *Active Cycle Of Breathing Technique* Untuk Mengatasi Masalah Bersihan Jalan Nafas Pada Pasien Tuberkulosis Paru Dengan Bronkiektasis : Studi Kasus. Volume 4, Nomor 1.	The sample size of 1 person	To identify the effectiveness of the Active Cycle Breathing technique (ACT) nursing intervention in addressing the problem of ineffective airway clearance thru a series of breathing control techniques, deep breathing, and sputum expectoration techniques	single case study.	The ACT intervention was administered for 7 days, twice a day (morning and evening), for 15 minutes each time.	studyThere was an improvement in oxygenation status, a decrease in sputum production, and a reduction in shortness of breath.

Consistent with the research by Silvitasari & Purnamawati (2024), conducted over four days, which showed that the respiratory rate of respondents with pulmonary tuberculosis decreased with each ACBT therapy session, and the patients' shortness of breath was reduced [16]. Damayanti et al. (2025) also found in their research that the Active Cycle of Breathing Technique (ACBT) is effective in increasing oxygen saturation, decreasing respiratory rate, and increasing sputum production in patients with pulmonary tuberculosis [17]. Hosseini et al. (2021) discussed the effectiveness of ACBT in patients with pulmonary TB in their research, in line with the context of ineffective airway clearance [18].

Combining it with chest physiotherapy showed additional benefits, making ACBT a practical and safe option in TB rehabilitation. Despite methodological limitations such as small sample sizes, these findings support the integration of ACBT into standard treatment protocols to improve functional outcomes and patients' quality

of life [14]. Future research with larger, long-term RCT designs is needed to confirm long-term effectiveness and application in specific subpopulations.

In a case study of bronchiectasis, Active Cycle of Breathing Technique therapy was administered for 7 consecutive days, twice a day, and showed improvement in oxygenation, reduced sputum production, and shortness of breath [12]. Another study reported effective results after 3 days of intervention, with sputum expectoration occurring on day 3 [13]. Some experimental studies did not specify the duration, but generally, the intervention was performed for several days to a week, adjusting to the patient's condition and research objectives.

Based on the six articles reviewed, the Active Cycle of Breathing Technique (ACBT) consistently demonstrated effectiveness in managing patients with pulmonary tuberculosis (TB). With a total sample size of 90 patients (ranging from 1 to 40 patients per study), ACBT has been shown to improve airway clearance, breathing patterns and frequency, and reduce symptoms such as shortness of breath, cough, and sputum production [6,11,14,15]. These results are supported by statistically significant tests ($p < 0.05$ or $p = 0.00$) in most studies, indicating strong clinical benefits, especially when combined with chest physiotherapy or standard anti-TB treatment [14].

CONCLUSION

Based on monitoring six articles, the Active Cycle of Breathing Technique (ACBT) has consistently proven effective as a physiotherapy intervention for improving airway clearance, lung function, and respiratory symptoms, such as shortness of breath, in patients with pulmonary tuberculosis, with statistically significant evidence ($p < 0.05$). Several studies have shown that ACBT for 3 to 7 days can improve oxygen saturation, reduce respiratory rate, increase sputum production, and improve breathing patterns and frequency. This therapy is also considered safe and practical, and it provides real clinical benefits, especially when combined with chest physiotherapy or standard anti-TB treatment, making it an effective rehabilitation option in the management of patients with pulmonary TB.

AUTHORS' CONTRIBUTIONS

Nadila Sandia: Conceptualisation, Writing –reviewing & editing, Writing –original draft. **Sitti Johri Nasela** : Writing –review & editing, Methodology, Writing –original draft preparation. **Nur Baharia Marasabessy** : Writing –review & editing, Methodology,

Investigation. **Mutia Cut Tatisina**: Writing –review & editing, Writing –original draft, Visualisation, Validation.

DISCLOSURE STATEMENT

The authors declare that they have no financial conflicts of interest or personal relationships that could have influenced the results reported in this paper. The data were obtained from Google Scholar databases. The authors acknowledge that, although they have used these data for academic research purposes, they do not claim ownership of them. All authors contributed to the study's conception and design, literature collection, analysis, and interpretation of the results. The authors confirm that the manuscript has been read and approved by all named authors. The authors confirm that this manuscript is an original work that has not been published elsewhere and is not currently under consideration for publication elsewhere.

REFERENCE

1. 2022 W. Global Tuberculosis Report 2022. *Lap Resmi WHO Diterbitkan Oleh WHO Press*. https://www.who.int/publications/i/item/9789240061729
2. (YKI). YKTI. Laporan Kasus TBC Global dan Indonesia 2022. *YKI4TBC*. Published online 2022.
3. Kemenkes. Laporan Program Penanggulangan Tuberkulosis Tahun 2022. Kemenkes Ri. :1-156.
4. Yayasan KNCV indonesia. Laporan Kasus Tuberkulosis (TBC) Global Dan Indonesia 2022.
5. Saini S, iwan, Yakub A. Penerapan Teknik Batuk Efektif Untuk Meningkatkan Bersihan Jalan Nafas Tidak Efektif Pada Pasien Tuberkulosis Paru. *J Media Keperawatan Politek Kesehat Makassar*. 2024;15(2).
6. Defi Eka Kartika, Sandra, Yolanda M. The Effect Of Giving Active Cycle Of Therapy Breathing Technique (ACBT) On Respiratory Rate In Pulmonary Tuberculosis Patients At Arifin Achmad Hospital Riau Province. *Inf Dan Promosi Kesehat*. 2025;4(1):1-13. doi:10.58439/ipk.v4i1.278
7. Zisi D, Chryssanthopoulos C, Nanas S, Philippou A. The effectiveness of the active cycle of breathing technique in patients with chronic respiratory diseases: A systematic review. *Heart Lung*. 2022;53:89-98. doi:10.1016/j.hrtlng.2022.02.006
8. Varida Naibaho EN, Herlina Kabeakan SM. Pengaruh Terapi Active Cycle Of Breathing Technique (Acbt) Terhadap Frekuensi Pernafasan (Respiratory Rate) Pada Penderita Tuberkulosis Paru Di Rumah Sakit Umum Imelda Pekerja Indonesia Medan. *Indones Trust Health J*. 2021;4(2):499-506. doi:10.37104/ithj.v4i2.84
9. Siahaan A. Jurnal Kesehatan Masyarakat. *J Kesehat Masy*. 2018;14 (2):120-130.
10. Zhong J, Zhang S, Li C, et al. Active Cycle Of Breathing Technique May Reduce Pulmonary Complications After Esophagectomy: A Randomized Clinical Trial. *Thorac Cancer*. 2022;13(1):76-83. doi:10.1111/1759-7714.14227
11. Abdullah M, Ahmad M, Ahmad S, Imrana Ashraf H, Atta Rehman S. Effects of Active Cycle of Breathing Techniques on Pulmonary Function, Sputum Clearance, Chest Expansion, and Exercise Capacity in Tuberculosis Patients. *J Health Wellness Community Res*. Published online May 15, 2025. doi:10.61919/n0b9qr87
12. Endria V, Yona S, Waluyo A. Penerapan Active Cycle of Breathing Technique untuk Mengatasi Masalah Bersihan Jalan Nafas pada Pasien Tuberkulosis Paru dengan Bronkiektasis: Studi Kasus. *J Telenursing JOTING*. 2022;4(1):144-152. doi:10.31539/joting.v4i1.3435
13. Yoany Maria Vianney Bita Aty, Betrice Amelia Benu, Yustinus Rindu, Trivonia Sri Nurwela. Penerapan Teknik Active Cycle of Breathing Technique (ACBT) dalam Mengatasi Penumpukan

Sekret pada Penderita Tuberculosis Paru. *Sehat Rakyat J Kesehat Masy*. 2024;3(4):248-254. doi:10.54259/sehatrakyat.v3i4.3309
14. Risti Puji Listari, Eppy Setiyowati, Chilyatis Zahroh. Combination of Active Cycle of Breathing Techniques (ACBT) and Chest Physiotherapy on the Effectiveness of Airborne Cleaning in Pulmonary TB Patients. *J Nurs Pract*. 2025;8(3):650-656. doi:10.30994/jnp.v8i3.567
15. Pomalango ZB, Suleman I. Active Cycle Breathing Technique on Airway Clearance in Pulmonary TB Patients. *Jambura Nurs J*. 2024;6(2):192-201. doi:10.37311/jnj.v6i2.25228
16. Silvitasari I, Purnamawati F. Penerapan Terapi active Cycle Of Breathing Technique (ACBT) Untuk Menurunkan Respiratory Rate Pada Pasien Tb Paru Di Ruang Tulip Rsud dr. Soeratno Gemolong. 2024;(9).
17. Kk IFJ, Auliana H, Damayanti AD, et al. Application of Active Cycle Breathing Technique (ACBT) Exercises on Hemodynamic Status in Pulmonary Tuberculosis Patients With Respiratory Problems : A Case Study. *Lentera Perawat*. 2025;6(2):227-233. doi:10.52235/lp.v6i2.450
18. S. A H, A G, S.M A. The Effect Of Active Cycle Of Breathing Technique On Pulmonary Function In Patients With Pulmonary Tuberculosis. *J Res Med Sci*. 2021;26(1).
19. Haryati W. Penerapan Latihan Pernafasan Active Cycle Of Breathing Dalam Mengurangi Gangguan Bersihan Jalan Nafas Pada Pasien Tuberkulosis Paru.
20. Saputra Biu H, Nurliah. Efektifitas Teknik Pernafasan Active Cycle Of Brathing Technique (ACBT) Terhadap Saturasi Oksigen, Frekuensi Pernafasan, Dan Produksi Sputum Pada Pasien TB Paru Di Ruangan Isolasi RSUD. Prof. Dr. H. Aloei Saboe. *J TSCNers*. 2025;10(1).