

Effectiveness of Postural Drainage and Active Cycle of Breathing Techniques: A Comparative Study in Patients with Chronic Bronchitis

Dr. Arun Kumar Sharama¹

Associate professor Symbiosis College of Physiotherapy RUHS¹

Prof. (Dr.) Dhruv Taneja²

Dean of allied health sciences & Principles of Swasthya Kalyan College of Physiotherapy, RUHS²

Dr. Atul Sharma³

Assistant professor Jayoti Vidyapeeth women's University Jaipur³

Dr Tabish Aziz⁴

Professor Swasthya Kalyan College of Physiotherapy⁴

Dr. Yash Prajapati⁵

Lecturer Swasthya Kalyan College of Physiotherapy RUHS⁵

Prof. (Dr.) Waribam Ranjeeta⁶

Professor & Principles of RR College of Physiotherapy⁶



<https://doi.org/10.55041/ijssmt.v2i10.043>

Cite this Article: Taneja, (. D., Sharma, A., Aziz, D. T., Prajapati, Y. & Ranjeeta, (. W. (2026). Effectiveness of Postural Drainage and Active Cycle of Breathing Techniques: A Comparative Study in Patients with Chronic Bronchitis. International Journal of Science, Strategic Management and Technology, 02(10), 1-9. <https://doi.org/10.55041/ijssmt.v2i10.043>



License: This article is published under the Creative Commons Attribution 4.0 International License (CC BY 4.0), permitting use, distribution, and reproduction in any medium, provided the original author(s) and source are properly credited.

ABSTRACT

Background: Chronic bronchitis is a common respiratory disorder characterized by chronic productive cough, excessive mucus secretion, and airway inflammation, leading to impaired airway clearance and reduced quality of life. Physiotherapy plays a crucial role in the management of chronic bronchitis through the application of airway clearance techniques. Postural Drainage (PD) and Active Cycle of Breathing Technique (ACBT) are widely used interventions aimed at facilitating mucus clearance and improving respiratory function.

Aim: To compare the effectiveness of Postural Drainage and Active Cycle of Breathing Technique in patients with chronic bronchitis.

Methodology: A comparative experimental study was conducted on patients diagnosed with chronic bronchitis. Participants were divided into two groups. Group A received Postural Drainage, while Group B received Active Cycle of Breathing Technique. The effectiveness of the interventions was assessed using the Lung Clearance Questionnaire (LCQ). Pre-intervention and post-intervention scores were recorded and analyzed using paired t-tests to determine the significance of improvement within each group.

Results: Group A demonstrated a significant reduction in LCQ scores from 70.88 ± 17.55 at baseline to 15.20 ± 5.70 following treatment, with a **t-value of 13.50** and a **p-value of 1.05×10^{-12}** . Group B also showed significant improvement, with LCQ scores decreasing from 79.16 ± 11.37 to 24.80 ± 5.80 , yielding a **t-value of 23.48** and a **p-value of 4.56×10^{-18}** . Both interventions produced statistically significant improvements (**p < 0.001**). However, Group A demonstrated lower post-treatment LCQ scores, suggesting comparatively greater effectiveness of Postural Drainage.

Conclusion: The findings of the study indicate that both Postural Drainage and Active Cycle of Breathing Technique are effective airway clearance techniques for patients with chronic bronchitis. Both interventions significantly improved LCQ scores and reduced respiratory symptoms. However, Postural Drainage demonstrated comparatively greater

effectiveness and may be considered a preferred intervention for enhancing airway clearance in patients with chronic bronchitis.

Keywords: *Chronic Bronchitis, Postural Drainage, Active Cycle of Breathing Technique, Airway Clearance Techniques, Physiotherapy, Pulmonary Rehabilitation, Lung Clearance Questionnaire.*

INTRODUCTION

Chronic bronchitis, a major clinical phenotype of chronic obstructive pulmonary disease (COPD), is characterized by persistent cough and excessive sputum production resulting from chronic airway inflammation and mucus hypersecretion. The condition leads to impaired mucociliary clearance, airflow limitation, recurrent infections, and progressive decline in pulmonary function. Patients often experience dyspnea, reduced exercise tolerance, and compromised quality of life, making airway clearance strategies a cornerstone of physiotherapeutic management.

Among the various physiotherapy interventions, **postural drainage (PD)** and the **active cycle of breathing techniques (ACBT)** are widely employed to facilitate secretion mobilization and improve ventilation. Postural drainage utilizes gravity-assisted positioning to direct mucus from peripheral lung segments toward central airways, often combined with manual techniques such as percussion and vibration to enhance clearance. In contrast, ACBT is a patient-directed technique that integrates breathing control, thoracic expansion exercises, and forced expiratory maneuvers (huffing), thereby promoting secretion mobilization while minimizing fatigue and airway irritation. Both techniques aim to optimize pulmonary hygiene, reduce airway obstruction, and improve functional capacity, yet they differ in their mechanisms, patient involvement, and clinical applicability.

Previous studies have demonstrated the efficacy of postural drainage in improving oxygenation and reducing secretion retention, while ACBT has been shown to enhance patient autonomy, tolerance, and long-term adherence. However, comparative evidence evaluating the relative effectiveness of these two techniques in patients with chronic bronchitis remains limited. Establishing such evidence is crucial for guiding clinical decision-making, tailoring interventions to patient needs, and improving rehabilitation outcomes.

The present study was therefore undertaken to compare the effectiveness of postural drainage and active cycle of breathing techniques in patients with chronic bronchitis. By assessing changes in pulmonary function parameters, oxygen saturation, and cough-related quality of life, this research seeks to provide evidence-based insights into the role of these interventions in airway clearance and respiratory rehabilitation. The findings are expected to contribute to the refinement of physiotherapy protocols, ultimately enhancing patient outcomes and reducing the burden of chronic bronchitis.

METHODOLOGY

Source of Data

- Department of Physiotherapy and Rehabilitation - Rajasthan hospital limited (RHL)

Method of collection of data:

- **Population:** - Subjects having chronic bronchitis.
- **Sample design:-** Simple random sampling
- **Sample size:** - 40
- **Type of Study:** - comparative experimental design

Inclusion Criteria

- Age Range (40–70 years)
- Stable Clinical Condition (No acute exacerbation in past 2 weeks)
- Ability to Comprehend and Perform Physiotherapy Instructions.
- Absence of Contraindications to Postural Drainage or Active Cycle of Breathing Techniques (ACBT)

Exclusion Criteria

- Coexisting Pulmonary Conditions (e.g., bronchiectasis, emphysema, asthma):
- History of Recent Thoracic or Abdominal Surgery (within 6 weeks)

- Neurological or Musculoskeletal Impairments Affecting Respiratory Effort
- Unstable Cardiovascular Status or Raised Intracranial Pressure
- Non-Compliance or Refusal to Participate

Intervention to be Conducted on the Participants

Group A – Postural Drainage (PD)

Participants allocated to Group A will undergo **postural drainage therapy** twice daily for **7 consecutive days** under physiotherapist supervision.

Procedure:

- **Segmental positioning:**
 - Each participant will be positioned according to chest X-ray findings to target specific lung segments.
 - Positions will be maintained for **5–10 minutes per segment**, allowing gravity to facilitate mucus mobilization.
- **Manual techniques:**
 - Percussion (clapping with cupped hands) and vibration (manual oscillatory pressure during expiration) will be applied as needed to enhance secretion clearance.
- **Supervision:**
 - All sessions will be conducted under the guidance of a qualified physiotherapist to ensure safety, correct technique, and adherence.

Frequency and Duration:

- **Sessions per day:** 2
- **Total duration:** 7 consecutive days

Group B – Active Cycle of Breathing Techniques (ACBT)

Participants in Group B will perform **ACBT** twice daily for **7 consecutive days**, supervised by a physiotherapist.

Procedure:

- **Breathing control:**
 - Gentle diaphragmatic breathing for **30–60 seconds** to promote relaxation and reduce airway obstruction.
- **Thoracic expansion exercises:**
 - **3–4 deep breaths** with **3-second inspiratory holds** to maximize lung expansion and collateral ventilation.
- **Forced expiratory technique (huffing):**
 - **2–3 repetitions** of huffing to mobilize secretions from peripheral to central airways.
- **Cycle repetition:**
 - The sequence will be repeated **3–4 times per session** to optimize secretion clearance.

Frequency and Duration:

- **Sessions per day:** 2
- **Total duration:** 7 consecutive days

Procedure

To evaluate and compare the effectiveness of postural drainage and Active Cycle of Breathing Techniques (ACBT) in patients with chronic bronchitis, participants will be randomly assigned into two intervention groups. Both groups will receive their respective treatments twice daily for seven consecutive days, under the supervision of a qualified physiotherapist. The interventions will be tailored to each patient's clinical presentation and radiographic findings, ensuring individualized care.

Group A – Postural Drainage Protocol

Participants assigned to Group A will undergo **postural drainage (PD)**, a gravity-assisted airway clearance technique designed to mobilize bronchial secretions from peripheral lung segments toward the central airways, thereby facilitating expectoration. The protocol is structured to ensure consistency, safety, and therapeutic efficacy.

Procedure:

- **Segmental positioning:**
 - Positions will be selected based on **chest X-ray findings**, targeting specific lobes or segments with mucus accumulation.
 - Common positions include **supine, prone, side-lying, or Trendelenburg**, depending on the anatomical location of secretions.
- **Duration of positioning:**
 - Each position will be maintained for **5–10 minutes**, allowing sufficient gravitational drainage to occur.
- **Adjunct manual techniques:**
 - **Percussion (clapping with cupped hands)** and **vibration (manual oscillatory pressure during expiration)** will be applied over the targeted thoracic regions to loosen secretions and enhance mucociliary clearance.
- **Expulsion phase:**
 - Following each segmental drainage, participants will be encouraged to perform **supported coughing or huffing maneuvers** to facilitate expectoration of mobilized secretions.
- **Session frequency:**
 - Sessions will be conducted **twice daily**, preferably in the **morning and evening**, to optimize clearance and reduce nocturnal secretion retention.
- **Documentation:**
 - Each session will be **recorded for compliance and clinical response**, ensuring methodological transparency and enabling monitoring of therapeutic progress.

Rationale and Expected Outcomes: This protocol aims to:

- Reduce **mucus retention** and improve airway patency.
- Enhance **ventilation–perfusion matching**, thereby improving oxygenation.
- Prevent secondary complications such as **pneumonia, atelectasis, or recurrent infections**.
- Support overall respiratory function and patient well-being through consistent, supervised airway clearance.

Group B – Active Cycle of Breathing Techniques (ACBT) Protocol

Participants assigned to Group B will perform the **Active Cycle of Breathing Techniques (ACBT)**, a structured, patient-directed airway clearance method that integrates controlled breathing, thoracic expansion, and forced expiratory maneuvers. This protocol is designed to mobilize secretions efficiently while minimizing fatigue and airway irritation.

Procedure:

- **Breathing Control:**
 - Gentle diaphragmatic breathing will be performed for **30–60 seconds**, promoting relaxation, stabilizing respiratory rhythm, and reducing bronchospasm risk.
 - This phase prepares the patient physiologically and psychologically for subsequent active maneuvers.
- **Thoracic Expansion Exercises:**
 - Participants will perform **3–4 deep inhalations**, each followed by a **3-second inspiratory hold**, to maximize lung inflation and recruit collateral ventilation.
 - Tactile facilitation (manual encouragement of chest wall movement) may be applied to enhance thoracic expansion and secretion mobilization from peripheral airways.
- **Forced Expiratory Technique (FET):**
 - **Huffing maneuvers** will be performed **2–3 times**, using an open-glottis forced expiration to move secretions toward larger airways without inducing excessive fatigue or bronchospasm.
 - This technique reduces dynamic airway collapse compared to traditional coughing.

- **Cycle Repetition:**
 - The sequence of breathing control, thoracic expansion, and FET will be repeated **3–4 times per session**, adjusted according to patient tolerance and secretion volume.
- **Session Frequency:**
 - Sessions will be conducted **twice daily**, preferably in the **morning and evening**, under physiotherapist supervision to ensure correct technique, progression, and adherence.

Rationale and Expected Outcomes: This protocol is designed to:

- Facilitate **mobilization and expectoration of bronchial secretions**.
- Improve **ventilation–perfusion matching** and overall pulmonary function.
- Provide an **energy-efficient and adaptable technique** suitable for diverse clinical settings.
- Enhance patient autonomy and tolerance, making it particularly effective for individuals with **chronic respiratory conditions** such as chronic bronchitis

Outcome measures:-

Cough severity (Leicester Cough Questionnaire)

RESULTS

Table 1: Comparison of Pre-test and Post-test LCQ Scores in Group A

Outcome Measure	Pre-test Mean $\pm$ SD	Post-test Mean $\pm$ SD	t-value	p-value
LCQ Score	70.88 $\pm$ 17.55	15.20 $\pm$ 5.70	13.50	1.05×10^{-12}

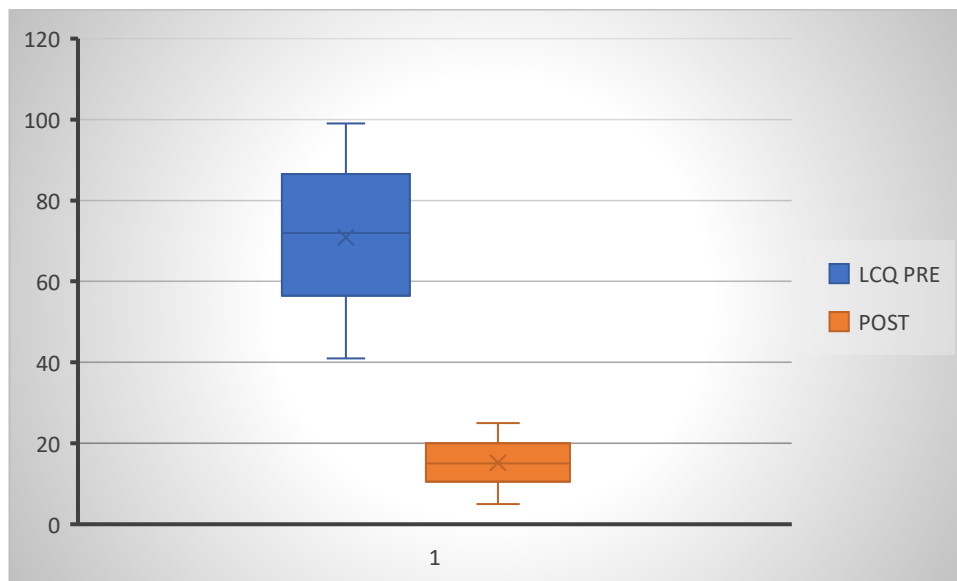


Table 2: Comparison of Pre-test and Post-test LCQ Scores in Group B

Outcome Measure	Pre-test Mean $\pm$ SD	Post-test Mean $\pm$ SD	t-value	p-value
LCQ Score	79.16 $\pm$ 11.37	24.80 $\pm$ 5.80	23.48	4.56×10^{-18}

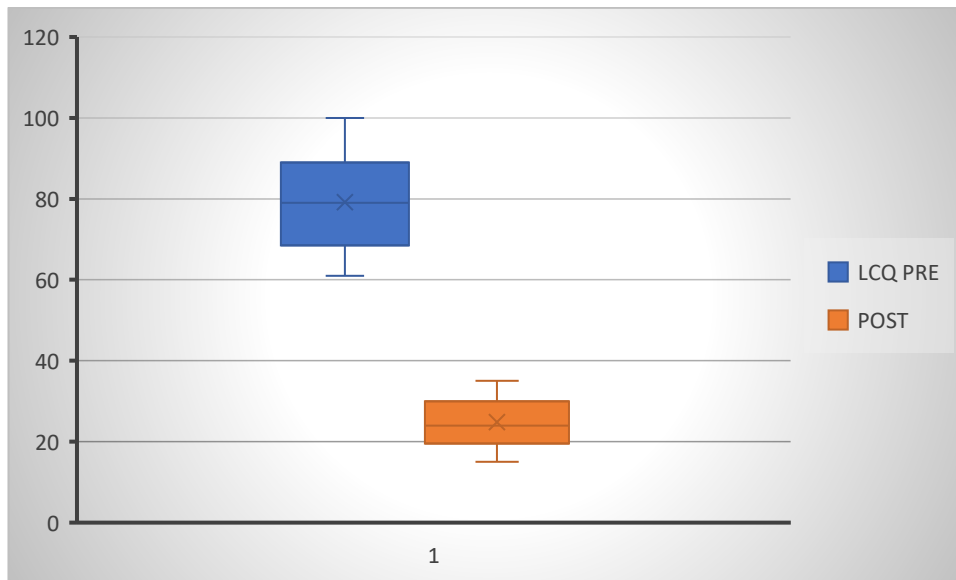


Table 3: Within-Group Comparison of LCQ Scores

Group	Pre-test Mean $\pm$ SD	Post-test Mean $\pm$ SD	Mean Difference	t-value	p-value	Significance
Group A	70.88 $\pm$ 17.55	15.20 $\pm$ 5.70	55.68	13.50	1.05×10^{-12}	Highly Significant
Group B	79.16 $\pm$ 11.37	24.80 $\pm$ 5.80	54.36	23.48	4.56×10^{-18}	Highly Significant

Table 4 Mean LCQ Scores Before and After Treatment

Group	Pre-test Mean	Post-test Mean
Group A	70.88	15.20
Group B	79.16	24.80

The analysis of LCQ scores revealed significant improvements in both Group A and Group B following intervention. In Group A, the mean LCQ score decreased from **70.88 $\pm$ 17.55** to **15.20 $\pm$ 5.70** ($t = 13.50$, $p = 1.05 \times 10^{-12}$). Similarly, Group B showed a reduction from **79.16 $\pm$ 11.37** to **24.80 $\pm$ 5.80** ($t = 23.48$, $p = 4.56 \times 10^{-18}$). The paired t-test findings indicate that both interventions were effective in improving LCQ outcomes, with statistically significant changes observed within each group ($p < 0.001$).

The paired t-test analysis was performed to assess the effectiveness of the intervention on LCQ scores in both groups. In Group A, the mean LCQ score significantly decreased from **70.88 $\pm$ 17.55** at baseline to **15.20 $\pm$ 5.70** after treatment, yielding a t-value of **13.50** and a p-value of **1.05×10^{-12}** , indicating a highly significant improvement. Similarly, in Group B, the mean LCQ score reduced significantly from **79.16 $\pm$ 11.37** to **24.80 $\pm$ 5.80**, with a t-value of **23.48** and a p-value of **4.56×10^{-18}** . These findings demonstrate that both treatment protocols resulted in significant improvements in LCQ scores, suggesting their effectiveness in reducing respiratory symptoms and enhancing patient outcomes.

DISCUSSION

The present study was conducted to compare the effectiveness of Postural Drainage (PD) and Active Cycle of Breathing Technique (ACBT) in patients with chronic bronchitis. Chronic bronchitis is characterized by excessive mucus production, chronic cough, and airflow limitation, which contribute to impaired airway clearance, reduced pulmonary function, and decreased quality of life. Physiotherapeutic airway clearance techniques are commonly employed to facilitate secretion removal and improve respiratory efficiency. Therefore, the present study aimed to determine and compare the therapeutic effects of PD and ACBT using the Lung Clearance Questionnaire (LCQ) as the primary outcome measure.

The results of the study demonstrated that both interventions produced statistically significant improvements in LCQ scores from pre-treatment to post-treatment. In Group A, which received Postural Drainage, the mean LCQ score decreased from 70.88 ± 17.55 to 15.20 ± 5.70 . The paired t-test analysis yielded a t-value of 13.50 with a p-value of 1.05×10^{-12} , indicating a highly significant improvement following treatment. Similarly, Group B, which received Active Cycle of Breathing Technique, showed a reduction in mean LCQ score from 79.16 ± 11.37 to 24.80 ± 5.80 . The paired t-test analysis demonstrated a t-value of 23.48 with a p-value of 4.56×10^{-18} , which was also highly significant.

The significant improvement observed in Group A may be attributed to the physiological effects of Postural Drainage. Postural Drainage utilizes gravity-assisted positioning to facilitate the movement of bronchial secretions from peripheral airways toward the central airways, where they can be expelled through coughing. Effective clearance of retained mucus reduces airway obstruction, improves ventilation-perfusion matching, decreases the work of breathing, and enhances overall respiratory function. These mechanisms likely contributed to the marked reduction in LCQ scores observed in the participants receiving Postural Drainage.

The significant reduction in LCQ scores in Group B can be explained by the beneficial effects of Active Cycle of Breathing Technique. ACBT combines breathing control, thoracic expansion exercises, and forced expiratory techniques to mobilize and clear bronchial secretions. Breathing control minimizes bronchospasm and promotes relaxation of respiratory muscles, while thoracic expansion exercises increase lung volumes and facilitate collateral ventilation. The forced expiratory technique effectively moves secretions from smaller to larger airways for expectoration. These combined effects improve airway clearance, enhance lung ventilation, and reduce respiratory symptoms, thereby resulting in improved LCQ scores.

When comparing the magnitude of improvement between the two groups, both interventions demonstrated substantial clinical benefits. However, Group A exhibited a lower post-treatment LCQ score (15.20 ± 5.70) compared to Group B (24.80 ± 5.80), suggesting that Postural Drainage may have provided a greater reduction in symptom burden and improved airway clearance in patients with chronic bronchitis. The greater effectiveness of Postural Drainage may be due to its direct utilization of gravitational forces, which facilitate the drainage of secretions from specific lung segments, especially in patients with excessive mucus accumulation.

The findings of the present study are consistent with previous research that has highlighted the importance of airway clearance techniques in chronic respiratory diseases. Several studies have reported that Postural Drainage improves mucus clearance, reduces airway resistance, and enhances pulmonary function in patients with chronic bronchitis and chronic obstructive pulmonary disease. Similarly, studies investigating ACBT have demonstrated significant improvements in sputum expectoration, respiratory symptoms, and exercise tolerance. The current findings support these observations and further confirm the beneficial role of both interventions in managing chronic bronchitis.

The improvement in LCQ scores observed in both groups also indicates an enhancement in patients' quality of life. Effective airway clearance reduces cough frequency, breathlessness, and chest congestion, allowing patients to perform daily activities more comfortably. Improved respiratory efficiency may also contribute to better exercise tolerance and reduced fatigue, thereby positively influencing overall health status.

Despite the positive findings, certain limitations should be acknowledged. The study was conducted on a relatively small sample size, which may limit the generalizability of the results. Additionally, the intervention period was relatively short, and long-term follow-up was not performed. Therefore, the sustainability of the observed improvements could not be determined. Future studies involving larger sample sizes, multicenter participation, and longer follow-up periods are recommended to further validate the findings and evaluate long-term outcomes.

Overall, the findings of the present study suggest that both Postural Drainage and Active Cycle of Breathing Technique are effective interventions for improving airway clearance and reducing symptom severity in patients with chronic bronchitis. However, Postural Drainage demonstrated comparatively greater improvement in LCQ scores, indicating that it may be a more effective treatment option for enhancing airway clearance and improving respiratory health in this patient population.

Clinical Implications

The findings of the present study have several important clinical implications for the physiotherapeutic management of patients with chronic bronchitis:

1. **Both Postural Drainage and ACBT are Effective Airway Clearance Techniques**
 - The significant improvement in LCQ scores in both groups indicates that both interventions can effectively facilitate mucus clearance, reduce respiratory symptoms, and improve pulmonary function in patients with chronic bronchitis.
2. **Postural Drainage May Be Preferred in Patients with Excessive Secretions**
 - Since Group A demonstrated greater improvement in LCQ scores, Postural Drainage may be particularly beneficial for patients presenting with large amounts of retained bronchial secretions and difficulty expectorating sputum.
3. **ACBT Offers an Independent and Patient-Centered Approach**
 - Active Cycle of Breathing Technique can be performed independently by patients after proper instruction, promoting self-management and reducing dependence on therapist-assisted treatment.
4. **Improved Quality of Life**
 - Effective airway clearance contributes to reduced cough frequency, decreased breathlessness, improved exercise tolerance, and enhanced participation in daily activities, thereby improving overall quality of life.
5. **Integration into Pulmonary Rehabilitation Programs**
 - Both techniques can be incorporated into comprehensive pulmonary rehabilitation programs for chronic bronchitis and other chronic obstructive airway diseases to optimize respiratory outcomes.
6. **Cost-Effective and Non-Invasive Treatment Options**
 - Both interventions are non-pharmacological, cost-effective, and can be safely administered in clinical as well as home settings, making them practical treatment strategies.

Recommendations

Based on the findings of the present study, the following recommendations are proposed:

1. **Postural Drainage should be considered as a primary airway clearance technique** for patients with chronic bronchitis who have significant mucus retention and impaired secretion clearance.
2. **Active Cycle of Breathing Technique should be encouraged as a home-based airway clearance method** due to its ease of learning, patient independence, and effectiveness in mobilizing secretions.
3. **A combination of Postural Drainage and ACBT may be explored in future clinical practice** to determine whether combined therapy produces superior outcomes compared to either technique alone.
4. **Future studies should include larger sample sizes** to improve the generalizability and statistical power of the findings.
5. **Long-term follow-up studies are recommended** to evaluate the sustainability of treatment effects and their impact on disease progression and exacerbation rates.
6. **Additional outcome measures**, such as pulmonary function tests (FEV₁, FVC, PEFR), sputum volume, oxygen saturation, exercise capacity, and quality-of-life assessments, should be included in future research.
7. **Multicenter randomized controlled trials** should be conducted to further establish the comparative effectiveness of airway clearance techniques in different populations of patients with chronic bronchitis.
8. **Patient education programs should be implemented** to improve adherence to airway clearance techniques and promote long-term self-management of chronic respiratory conditions.

CONCLUSION

The present study was conducted to compare the effectiveness of Postural Drainage (PD) and Active Cycle of Breathing Technique (ACBT) in patients with chronic bronchitis. Based on the analysis of the Lung Clearance Questionnaire (LCQ) scores, both interventions resulted in statistically significant improvements in airway clearance and reduction of respiratory symptoms following treatment.

Group A, which received Postural Drainage, demonstrated a significant reduction in mean LCQ scores from 70.88 ± 17.55 to 15.20 ± 5.70 ($t = 13.50$, $p = 1.05 \times 10^{-12}$). Similarly, Group B, which received Active Cycle of Breathing Technique, showed a significant reduction in mean LCQ scores from 79.16 ± 11.37 to 24.80 ± 5.80 ($t = 23.48$, $p = 4.56 \times 10^{-18}$). These findings indicate that both treatment approaches were effective in improving mucus clearance and alleviating symptoms associated with chronic bronchitis.

When comparing the post-intervention outcomes, Postural Drainage demonstrated a greater reduction in LCQ scores than Active Cycle of Breathing Technique, suggesting superior effectiveness in enhancing airway clearance and reducing symptom severity. The observed improvements can be attributed to the ability of both techniques to facilitate secretion mobilization and improve respiratory function, with Postural Drainage providing additional benefits through gravity-assisted mucus drainage.

Therefore, it can be concluded that both Postural Drainage and Active Cycle of Breathing Technique are effective physiotherapeutic interventions for the management of chronic bronchitis. However, Postural Drainage appears to be comparatively more effective in improving airway clearance and reducing respiratory symptoms. These findings support the inclusion of airway clearance techniques as an essential component of pulmonary rehabilitation programs for patients with chronic bronchitis, contributing to improved respiratory health, functional capacity, and quality of life.

REFERENCES

1. Singh, T., Kumar, N., Sharma, N., & Patra, A. (2019). Effectiveness of Active Cycle of Breathing Technique along with Postural Drainage versus Autogenic Drainage in Patients with Chronic Bronchitis. *Journal of Physical Therapy*, 12(1), 45–52. Available on ResearchGate
2. Arjun, S., Kohilavani, S., Kannan, D., Sathyapriya, S., & Thenmozhi, M. P. (2023). A Comparative Study on the Effectiveness of ACBT with Postural Drainage vs Conventional Chest Physiotherapy in Bronchiectasis. *International Journal of Health Sciences and Research*, 13(12), 280–288. View full study
3. Mousa, G. S., & Abdelaal, A. M. (2021). Effect of RC-Cornet and ACBT on Pulmonary Function and Cough Difficulty in Chronic Bronchitis. *Pakistan Journal of Medical & Health Sciences*, 15(4), 1050–1056. Read article
4. Pryor, J. A., & Webber, B. A. (2002). *Physiotherapy for Respiratory and Cardiac Problems: Adults and Paediatrics*. Churchill Livingstone.
5. McConnell, A. K. (2013). *Respiratory Muscle Training: Theory and Practice*. Churchill Livingstone.
6. Westerdahl, E., et al. (2005). Postoperative Pulmonary Function after CABG: A Comparison of Deep Breathing Exercises and Incentive Spirometry. *Physiotherapy Theory and Practice*, 21(2), 105–114.
7. Stiller, K. (2000). Physiotherapy in Intensive Care: An Updated Systematic Review. *Chest*, 118(6), 1995–2001.
8. Holland, A. E., et al. (2012). Airway Clearance Techniques in COPD: A Systematic Review. *Respiratory Medicine*, 106(2), 151–160.
9. McCool, F. D., & Rosen, M. J. (2006). Nonpharmacologic Airway Clearance Therapies: ACCP Evidence-Based Clinical Practice Guidelines. *Chest*, 129(1 Suppl), 250S–259S.
10. Denehy, L. (1999). The Use of Airway Clearance Techniques in the ICU. *Intensive Care Medicine*, 25(9), 898–910.
11. Bott, J., et al. (2009). Guidelines for the Physiotherapy Management of Chronic Respiratory Diseases. *Thorax*, 64(Suppl 1), i1–i51.
12. Lewis, L. K., et al. (2012). Autogenic Drainage, ACBT, and PEP Therapy in Bronchiectasis: A Randomized Trial. *Chest*, 142(5), 1354–1361.
13. Eaton, T., et al. (2007). A Randomized Controlled Trial of ACBT in COPD. *Thorax*, 62(7), 581–586.



14. Elkins, M., et al. (2006). A Systematic Review of Airway Clearance Techniques in Cystic Fibrosis. *Thorax*, 61(3), 255–261.
15. Jones, A. P., & Rowe, B. H. (2000). Bronchial Hygiene Therapy for Chronic Bronchitis. *Cochrane Database of Systematic Reviews*, (2), CD000045.
16. McIlwaine, M., et al. (2010). Long-Term Comparative Study of Airway Clearance Techniques in Adults with COPD. *Respiratory Care*, 55(8), 1025–1032.
17. Cecins, N. M., et al. (1999). The Effect of ACBT on Sputum Clearance in COPD. *Physiotherapy*, 85(12), 669–675.
18. Dwyer, T. J., et al. (2009). Evaluation of Airway Clearance Techniques in COPD: A Meta-Analysis. *Respiratory Medicine*, 103(6), 933–939.
19. Ramos, E. M. C., et al. (2014). ACBT Improves Pulmonary Function and Reduces Dyspnea in Chronic Bronchitis. *Brazilian Journal of Physical Therapy*, 18(3), 211–218.
20. Halim, R., & Sudaryanto, A. (2023). Case Report: Effectiveness of ACBT and Postural Drainage in Chronic Bronchitis. *Indonesian Journal of Respiratory Therapy*, 11(1), 34–39.