Comparative Efficacy of Aerobika and MuClear Oscillatory Positive Expiratory Pressure Devices in Patients with Bronchiectasis: A Prospective Study

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ABSTRACT

Background: Bronchiectasis is characterized by impaired mucociliary clearance and retention of airway secretions, making airway-clearance therapy an important component of management. Oscillatory positive expiratory pressure (OPEP) devices facilitate mucus mobilization, but comparative evidence between individual devices remains limited.

Methods: This prospective comparative study included 90 adults with stable, non-cystic fibrosis bronchiectasis at Saveetha Medical College and Hospital from April to July 2025. Participants were allocated to Aerobika (n=45) or Mu-clear (n=45) groups according to device availability or patient preference. Both devices were used twice daily for 10–15 minutes for 12 weeks as an adjunct to standard treatment. Forced expiratory volume in one second (FEV_1% predicted), 24-hour sputum volume, and St. George's Respiratory Questionnaire (SGRQ) score were assessed at baseline and 12 weeks. Within-group changes were assessed using paired t-tests, and adjusted between-group differences were evaluated using ANCOVA.

Results: Baseline characteristics were comparable between groups. FEV_1% predicted increased significantly with Aerobika from 57.00±9.17% to 62.31±8.86% and with Mu-clear from 53.12±10.93% to 57.49±11.70% (both $p<0.001$). The adjusted improvement was significantly greater with Aerobika ($p=0.037$). Sputum volume increased from 39.16±8.36 to 53.18±7.32 mL/day with Aerobika and from 39.60±8.05 to 52.11±7.38 mL/day with Mu-clear (both $p<0.001$), without a significant between-group difference ($p=0.060$). SGRQ scores decreased significantly in both groups ($p<0.001$), with no significant between-group difference ($p=0.574$).

Conclusion: Both OPEP devices were associated with significant improvements in pulmonary function, sputum clearance, and health-related quality of life over 12 weeks. Aerobika produced a significantly greater improvement in FEV_1% predicted, while sputum clearance and quality-of-life outcomes were comparable between devices.

Keywords: Bronchiectasis; Aerobika; Mu-clear; Oscillatory positive expiratory pressure; Airway clearance; FEV_1; Sputum clearance; Quality of life.

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INTRODUCTION

Bronchiectasis is a chronic respiratory disorder characterised by permanent dilatation of the bronchi and is clinically associated with chronic cough, sputum production and recurrent respiratory infections. Impaired mucociliary clearance is a central component of the disease process and contributes to retention of airway secretions, persistent bacterial infection and chronic airway inflammation. These mechanisms may interact in a self-perpetuating cycle, ultimately contributing to progressive airway damage and deterioration in pulmonary function.[1]

Airway clearance is therefore an important component of bronchiectasis management, particularly in patients with excessive or retained airway secretions. Effective clearance of airway mucus may help reduce symptom burden, facilitate sputum expectoration and improve health-related quality of life. Current international guidance recommends that adults with bronchiectasis should be taught appropriate airway-clearance techniques, with the choice of technique individualised according to patient characteristics, preference and clinical circumstances. [2]

Among the available airway-clearance strategies, positive expiratory pressure (PEP) and oscillating positive expiratory pressure (OPEP) devices are commonly used to assist mucus mobilisation. OPEP therapy combines positive expiratory pressure with oscillations generated during expiration. The positive pressure may help maintain airway patency during expiration, while oscillatory airflow and pressure fluctuations may facilitate mobilisation of airway secretions towards the larger airways, where they can subsequently be expectorated by huffing or coughing. [3]

Evidence from clinical studies and systematic reviews suggests that OPEP therapy can improve sputum expectoration and some patient-reported outcomes in individuals with stable non-cystic fibrosis bronchiectasis. A systematic review by Lee et al. reported that oscillating PEP therapy was associated with increased sputum expectoration and improvements in disease-specific and cough-related quality of life compared with no treatment, while its effects on lung function and symptoms were broadly comparable with other airway-clearance techniques.[3] Subsequent evidence has continued to support the role of airway-clearance techniques as an important component of bronchiectasis care, although the available evidence does not establish clear superiority of one airway-clearance device over another.[2]

Aerobika and MuClear are handheld OPEP devices designed to facilitate airway secretion clearance. Although both devices are based on the principle of oscillatory positive expiratory pressure, direct comparative clinical

data evaluating their relative effects on pulmonary function, sputum clearance and health-related quality of life in patients with bronchiectasis remain limited. The absence of evidence demonstrating superiority of one airway-clearance technique over another also highlights the importance of evaluating commonly available devices in routine clinical practice.[2]

The present study was therefore undertaken to compare the efficacy of Aerobika and MuClear in adults with non-cystic fibrosis bronchiectasis receiving therapy over a 12-week period. The study evaluated changes in pulmonary function, measured by forced expiratory volume in one second (FEV_1), daily sputum volume as an objective measure of airway secretion clearance, and health-related quality of life assessed using the St. George's Respiratory Questionnaire (SGRQ).

MATERIALS AND METHODS

Study Design and Participants

This prospective comparative study was conducted at Saveetha Medical College and Hospital from **April to July 2025** among adults with confirmed non-cystic fibrosis bronchiectasis. A total of 90 patients were enrolled, with 45 patients in the Aerobika group and 45 in the Mu-clear group. Patients fulfilling the predefined eligibility criteria were recruited using a **consecutive sampling technique**. Group allocation was based on device availability or patient preference. Written informed consent was obtained from all participants.

Eligibility Criteria

Patients aged ≥18 years with confirmed non-cystic fibrosis bronchiectasis based on clinical history and high-resolution computed tomography (HRCT) findings were included. Patients were clinically stable, with no acute exacerbation for at least 4 weeks before enrolment. Patients with cystic fibrosis, active smoking, recent thoracic surgery, haemoptysis, or contraindications to vigorous coughing or positive-pressure manoeuvres were excluded.

Intervention

Following baseline assessment, participants were trained in the use of their assigned oscillating positive expiratory pressure (OPEP) device. They were instructed to perform approximately 10 breaths through the device followed by huff coughing to facilitate expectoration of mobilised secretions. The assigned device was used **twice daily for approximately 10–15 minutes per session** as an adjunct to standard treatment.

Outcome Measures

Assessments were performed at baseline and after 12 weeks of intervention. Pulmonary function was assessed using **forced expiratory volume in one second expressed as percentage of predicted value (FEV_1% predicted)**. Daily sputum clearance was assessed using **24-hour sputum volume**, recorded in mL/day. Health-related quality of life was assessed using the **St. George's Respiratory Questionnaire (SGRQ)**. Demographic characteristics, including age and sex, were also recorded.

For sputum assessment, participants were provided with a sputum collection container and instructed to collect their expectorated sputum over a **24-hour period**. The collected sputum volume was recorded as mL/day.

Statistical Analysis

Data were analysed using **SPSS software**. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Baseline continuous variables were compared between the Aerobika and Mu-clear groups using the **independent-samples *t*-test**, and categorical variables were compared using the **chi-square test**. Within-group changes from baseline to 12 weeks were assessed using the **paired-samples *t*-test**. Between-group differences in changes in the outcome measures were assessed using **analysis of covariance (ANCOVA)**, with the corresponding baseline value as a covariate. A two-sided p value <0.05 was considered statistically significant

RESULTS

A total of 90 patients with non-cystic fibrosis bronchiectasis were included in the analysis, with 45 patients in each group. The baseline demographic and clinical characteristics of the Aerobika and Mu-clear groups were comparable. No statistically significant differences were observed between the groups with respect to age, sex, baseline FEV_1% predicted, baseline sputum volume, or baseline SGRQ score (Table 1).

Pulmonary Function

At 12 weeks, FEV_1% predicted increased significantly in both groups. In the Aerobika group, mean FEV_1% predicted increased from **57.00 ± 9.17%** at baseline to **62.31 ± 8.86%** at 12 weeks, with a mean increase of **5.31 ± 1.78 percentage points** ($p < 0.001$). In the Mu-clear group, FEV_1% predicted increased from **53.12 ± 10.93%** to **57.49 ± 11.70%**, with a mean increase of **4.37 ± 2.18 percentage points** ($p < 0.001$).

After adjustment for baseline FEV_1% predicted using ANCOVA, the improvement in FEV_1% predicted was significantly greater in the Aerobika group than in the Mu-clear group ($p = 0.037$).

Sputum Clearance

Mean 24-hour sputum volume increased significantly in both groups following the intervention. In the Aerobika group, sputum volume increased from **39.16 ± 8.36 mL/day** at baseline to **53.18 ± 7.32 mL/day** at 12 weeks, representing a mean increase of **14.02 ± 3.93 mL/day** ($p < 0.001$). In the Mu-clear group, sputum volume increased from **39.60 ± 8.05 mL/day** to **52.11 ± 7.38 mL/day**, with a mean increase of **12.51 ± 3.89 mL/day** ($p < 0.001$).

After adjustment for baseline sputum volume, the between-group difference was not statistically significant ($p = 0.060$).

Health-Related Quality of Life

SGRQ scores decreased significantly in both groups after 12 weeks. In the Aerobika group, the mean SGRQ score decreased from **58.40 ± 7.35** at baseline to **50.09 ± 5.78** at 12 weeks, representing a mean reduction of **8.31 ± 4.97 points** ($p < 0.001$). In the Mu-clear group, the score decreased from **59.60 ± 6.56** to **50.49 ± 6.59**, representing a mean reduction of **9.11 ± 3.41 points** ($p < 0.001$).

After adjustment for baseline SGRQ score, there was no statistically significant difference between the groups ($p = 0.574$).

Both Aerobika and Mu-clear demonstrated significant within-group improvements in **FEV_1% predicted, 24-hour sputum volume, and SGRQ score** after 12 weeks. After adjustment for baseline values, **Aerobika demonstrated a significantly greater improvement in FEV_1% predicted**, whereas the between-group differences in sputum volume and SGRQ score were not statistically significant.

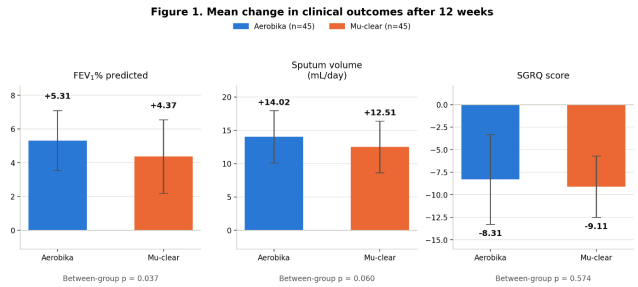

Figure 1. Comparison of mean changes in FEV₁%, sputum volume, and SGRQ score after 12 weeks between the Aerobika and Mu-clear groups.

Table 1. Baseline characteristics

Variable	Aerobika (n=45)	Mu-clear (n=45)	*p* value
Age, years	54.53 ± 9.39	55.87 ± 9.76	0.511
Male, n (%)	27 (60.0)	26 (57.8)	1.000
Female, n (%)	18 (40.0)	19 (42.2)	—
Baseline FEV₁% predicted	57.00 ± 9.17	53.12 ± 10.93	0.641
Baseline sputum volume, mL/day	39.16 ± 8.36	39.60 ± 8.05	0.892
Baseline SGRQ score	58.40 ± 7.35	59.60 ± 6.56	0.416

Outcome	Aerobika	Mu-clear	Between-group *p* value
FEV₁% predicted			
Baseline	57.00 ± 9.17	53.12 ± 10.93	0.641
12 weeks	62.31 ± 8.86	57.49 ± 11.70	—
Mean change	+5.31 ± 1.78	+4.37 ± 2.18	**0.037**
Sputum volume (mL/day)			
Baseline	39.16 ± 8.36	39.60 ± 8.05	0.892
12 weeks	53.18 ± 7.32	52.11 ± 7.38	—
Mean change	+14.02 ± 3.93	+12.51 ± 3.89	0.060
SGRQ score			
Baseline	58.40 ± 7.35	59.60 ± 6.56	0.416
12 weeks	50.09 ± 5.78	50.49 ± 6.59	—
Mean change	−8.31 ± 4.97	−9.11 ± 3.41	0.574

Table 2. Changes in study outcomes after 12 weeks

Values are expressed as mean ± SD. Within-group changes were statistically significant for all three outcomes ($p < 0.001$).

DISCUSSION

Bronchiectasis is associated with impaired mucociliary clearance, chronic airway inflammation, and recurrent respiratory infection, making effective airway clearance an important component of disease management. In the present study, both Aerobika and Mu-clear used twice daily for 12 weeks were associated with significant improvements in pulmonary function, sputum clearance, and health-related quality of life. However, Aerobika demonstrated a significantly greater improvement in FEV₁% predicted, whereas the between-group differences in sputum volume and SGRQ score were not statistically significant.

The improvement in FEV₁% predicted observed in both groups may be related to improved mobilisation and expectoration of airway secretions following OPEP therapy. OPEP devices generate positive expiratory pressure and oscillatory airflow during expiration, which may facilitate mucus mobilisation and movement of secretions towards the larger airwaysA systematic review of OPEP therapy in stable non-cystic fibrosis bronchiectasis reported improved sputum expectoration and disease-specific quality of life compared with no treatment, while effects on lung function were broadly comparable with other airway-clearance techniques. [3]

In the present study, FEV₁% predicted increased by **5.31 ± 1.78 percentage points** in the Aerobika group and by **4.37 ± 2.18 percentage points** in the Mu-clear group. The between-group difference was statistically significant ($p = 0.037$). This finding suggests a possible advantage of Aerobika in improving pulmonary function over the 12-week treatment period. However, the difference should be interpreted cautiously because the study was non-randomized and allocation was based on device availability or patient preference.

Both groups also demonstrated significant increases in 24-hour sputum volume. The mean increase was **14.02 ± 3.93 mL/day** with Aerobika and **12.51 ± 3.89 mL/day** with Mu-clear. However, the between-group difference was not statistically significant ($p = 0.060$). These findings are consistent with previous comparative evidence indicating that airway-clearance devices can facilitate secretion clearance, without establishing clear superiority of one device over another. In a randomized crossover study of adults with stable non-cystic fibrosis bronchiectasis, Silva et al. found that both Flutter and Lung Flute augmented secretion clearance, although differences were observed at specific time points. [4]

The improvement in SGRQ score was also significant in both groups. The mean SGRQ score decreased by **8.31 ± 4.97 points** in the Aerobika group and **9.11 ± 3.41 points** in the Mu-clear group. However, the between-group difference was not statistically significant ($p = 0.574$). Previous evidence has demonstrated improvements in health-related quality of life following airway-clearance therapy, while comparative studies have not consistently demonstrated superiority of one technique over another. [3,5]

The findings are also consistent with the Cochrane review of airway-clearance techniques in bronchiectasis, which concluded that airway-clearance techniques appear safe and may improve sputum expectoration, selected measures of lung function, symptoms, and health-related quality of life in stable bronchiectasis. However, the review also emphasized the need for further evidence regarding the comparative effectiveness of different airway-clearance techniques. [6]

Evidence specifically evaluating Aerobika in bronchiectasis is limited but supportive. Kim et al. evaluated twice-daily Aerobika use for six months in patients with bronchiectasis

and frequent exacerbations and reported significant improvement in bronchiectasis-related health status during follow-up. Although that study was single-arm and therefore did not directly compare Aerobika with another device, its findings provide supportive evidence for the clinical use of Aerobika as an airway-clearance intervention. [7]

The absence of a statistically significant difference between Aerobika and Mu-clear in sputum volume and SGRQ score is clinically relevant. Current evidence supports airway-clearance techniques as an important component of bronchiectasis management, but available evidence does not establish that one specific airway-clearance technique is universally superior to another. The 2023 European Respiratory Society statement emphasizes that OPEP and other airway-clearance techniques have an established role in bronchiectasis care, while comparative evidence between techniques remains limited. [8]

Overall, both Aerobika and Mu-clear were associated with significant improvements in **FEV_1% predicted, 24-hour sputum volume, and SGRQ score** after 12 weeks of therapy. Aerobika demonstrated a significantly greater improvement in FEV_1% predicted, while no significant difference was observed between the two devices in sputum volume or SGRQ score. These findings support the use of OPEP devices as airway-clearance options in bronchiectasis, while suggesting that device selection may be individualized according to patient and practical considerations.

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