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(REVIEW ARTICLE)

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The impact of positive expiratory pressure vs airway clearance techniques other therapy on quality of life and hospitalization rates in bronchiectasis patients: A systematic review

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Abstract

Background: As per global guidelines, the present approach to treating bronchiectasis is to reduce additional harm to the airways by reducing inflammation and infection and enhancing airway clearance. The aim of this study was to compare the quality of life and hospitalization rates of individuals with bronchiectasis between positive expiratory pressure and other methods for airway clearance.

Method: Following the PRISMA guideline (9), this systematic review investigation was carried out. We looked through the electronic databases of PubMed, Google Scholar, and Cochrane for randomized controlled studies comparing the use of prescription PEP therapy to alternative ACTs for patients with stable or acute exacerbations of bronchiectasis. We focused on English-language publications that were released between 2003 and 2016.

Result: Included in this systematic review were four studies that were published between 2003 and 2015. Three studies involved individuals in clinical stability, while one study included adults experiencing a sudden exacerbation of bronchiectasis. According to the inclusion criteria, bronchiectasis was determined by HRCT in two investigations and by medical diagnosis in the other two studies.

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Conclusion: PEP therapy appears to have comparable effects to other ACTs on dyspnea symptoms, health-related Qol, and sputum expectoration when administered in a stable clinical state or during an acute exacerbation.

Keywords: Airway Clearance Techniques; Positive Expiratory Pressure; Bronchiectasis; Quality of Life; Hospitalization.

1. Introduction

The clinical features of bronchiectasis, a chronic respiratory disease, include exhaustion, dyspnea, and a persistent cough with mucus production (1). There are numerous recognized causes of bronchiectasis. It can arise from a severe respiratory infection, be associated with other disorders like alpha-1 antitrypsin deficiency, which is marked by inflammation or a compromised mucociliary clearance system, or have an unknown etiology (2).

Prior to a recent consensus agreed upon by Aliberti et al. (3), the term "non- cystic fibrosis bronchiectasis" was used to describe bronchiectasis unrelated to cystic fibrosis, undermining its severity, morbidity, and prognosis. As a result, bronchiectasis is now the accepted term to describe this condition. According to Cole et al. (4), bronchiectasis is the result of a recurrent cycle of infection and inflammation, wherein the infection causes chronic inflammation that impairs mucociliary clearance and damages tissue. These pathophysiological processes make subsequent infections more likely, and they also cause structural alterations to the airways through a cycle of increasing inflammation (4). Recurrent acute exacerbations, or flare-ups, are a hallmark of the pathogenesis (5), and they frequently necessitate hospitalization. Adults and children may be affected by this illness (6).

According to Chang et al. (6) and other worldwide recommendations, the current treatment of bronchiectasis focuses on minimizing further damage to the airways by lowering inflammation and infection and improving airway clearance. The prescription of antibiotics, anti-inflammatory medications, and mucolytics in addition to airway clearance strategies to aid in sputum clearance are suggested methods to do this (6). Regular airway clearing treatment has been linked to better HRQOL and a decrease in cough symptoms (7). According to a recently updated analysis, using airway clearing methods (ACTs) was linked to improvements in lung function, health related QOL, and sputum expectoration (production) when compared to no therapy (8).

In comparison to no treatment, oscillatory PEP therapy (with repeated vibrations) was linked to increased sputum expectoration, better disease-specific health related QOL, and improved cough-related QOL in people with stable bronchiectasis (8). A reduction in pulmonary hyperinflation, or being overinflated, was observed while using some ACTs, such as oscillatory PEP treatment (8). However, oscillatory PEP treatment produced comparable changes in sputum volume, dynamic lung volumes, and degree of dyspnea in patients with stable bronchiectasis when compared to other ACTs (8).

The purpose of this study was to examine the effects of positive expiratory pressure vs alternative therapies for airway clearing on patients' quality of life and hospitalization rates due to bronchiectasis.

2. Method

This systematic review study was conducted according to the Preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement (9). We searched PubMed, Google scholar and Cochrane electronic databases for randomized controlled trials where patients with stable or acute exacerbations of bronchiectasis were treated with prescription PEP treatment in comparison to other ACTs. We targeted articles published in the period from 2003 to 2016 in English.

A doctor's diagnosis or an HRCT with any level of disease severity was used to make the diagnosis of bronchiectasis. Studies with subjects both in a stable clinical condition and going through an acute exacerbation were included. If a participant satisfied the investigators' criterion of an acute exacerbation, or if their symptoms worsened and they needed medical attention, such as antibiotic medication, whether or not they needed to be hospitalized, we categorized them as suffering an acute exacerbation.

To ensure that all possible papers found through the search were included, four review writers independently went through the titles and abstracts of each study. After retrieving full-text publications, four review authors independently went through the text to identify research that should be included and noted the reasons why certain studies should not have been included. Disagreements were settled via discussion or, if necessary, by contacting the relevant author.

3. Results

In this systematic review we included 4 articles published in the period from 2003 to 2015. A minimum sample size of 10 and a maximum sample size of 36 people were included in the 4 included investigations (Table 1). Adults in clinical stability participated in three investigations (10–12) and adults having an abrupt exacerbation of bronchiectasis were included in one research (13). In two investigations, bronchiectasis was identified based on HRCT (10,11) and in two trials by medical diagnosis, in accordance with the inclusion criteria. The study's inclusion criteria for individuals with acute exacerbations included a diagnosis of bronchiectasis that had been present for at least a year and included symptoms such as coughing and sputum production (13). Two studies that included patients with stable illness described the severity of their condition based on spirometry (10,11). When bronchiectasis was significantly exacerbated, FEV1 varied from 36 to 49% expected (13).

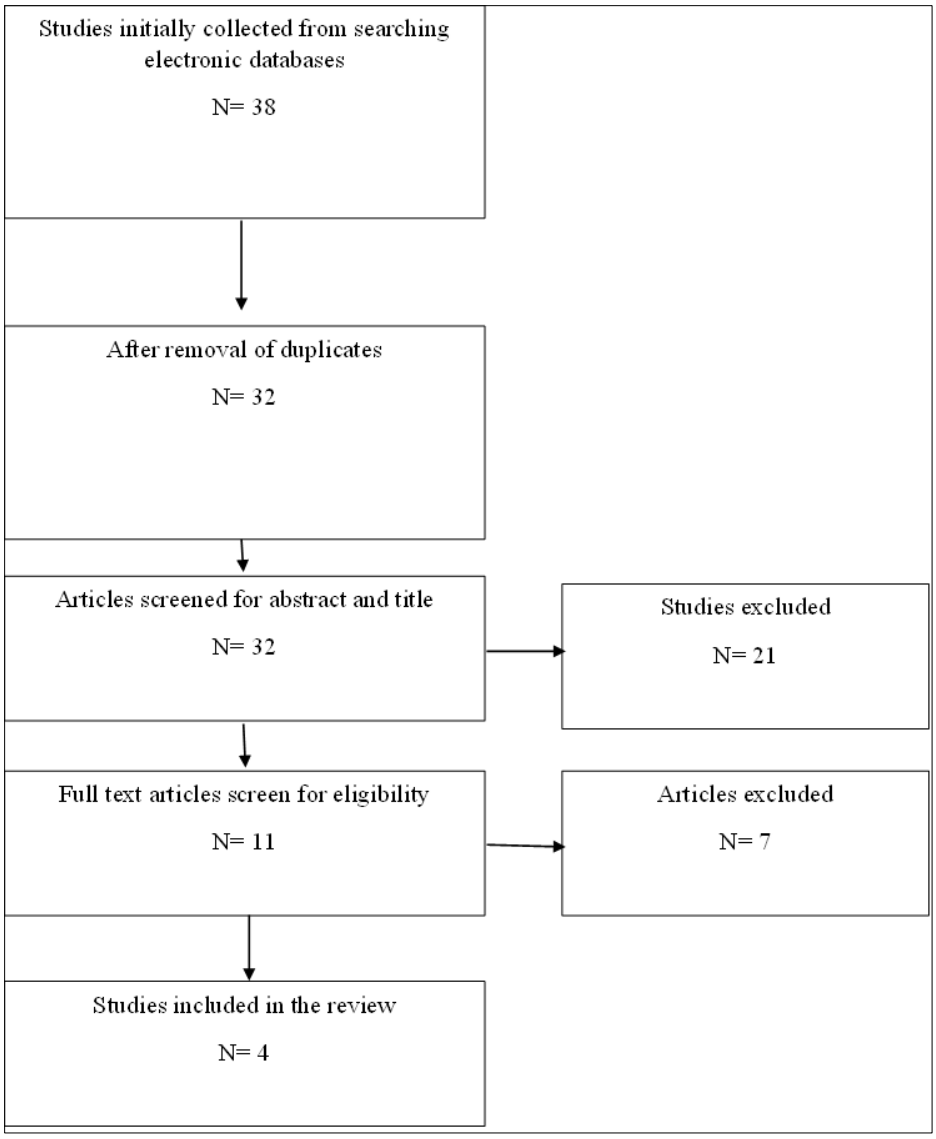

Figure 1 PRISMA consort chart

Three of the included studies (10–12) varied in how long they lasted. From the second day of admission until the day of release, the frequency in patients experiencing an acute exacerbation was three times per day (13). Two studies (10,11) did not use a washout period; one study (12) used a three-hour washout. Sputum weight or volume, which may be wet or dry, and spirometry measurements were included in all studies.

When oscillatory PEP treatment and ACBT were used in a sitting position, there was no difference in sputum weight or volume (10). Sputum weight (mean 15.8 g vs 16.2 g) and volume (mean 16.1 mL vs 16.3 mL) did not change between AD and oscillatory PEP therapy (Acapella) immediately after treatment (12).

Table 1 Characteristics and man findings of the included studies

Citation	Groups	Sample size	Main findings
Tsang et al. 2003	GAD vs Oscillatory PEP therapy	10	At every measurement point, there was no variation in the groups' sputum output or lung function metrics. Although all procedures were deemed equally straightforward to use by the patients, flutter was thought to be the most successful in removing secretions. It doesn't seem like postural drainage or flutter help remove secretions any more than coughing and breathing maneuvers does.
Patterson et al. 2005	GAD with ACBT vs Oscillatory PEP therapy	20	At baseline, no discernible variations were discovered, suggesting that the patients were stable. The weight of sputum expectorated with ACBT therapy and the weight of sputum expectorated with Acapella treatment did not differ significantly (mean difference 0.54 g). Acapella was selected by a larger percentage of patients.
Eaton et al. 2007	GAD vs Oscillatory PEP therapy GAD with ACBT vs Oscillatory PEP therapy	36	The combined moist weight of the sputum in ACBT- postural drainage was double that of Flutter or ACBT alone. There was no discernible change in the length of therapy. Each of the three approaches was welcomed and tolerated well. 44% of patients preferred Flutter, 22% preferred ACBT, and 33% preferred ACBT- postural drainage. Preference was not predicted by patient acute effectiveness, demographics, past usage, upper airway or reflux symptoms, or any of these characteristics. While all three methods were well tolerated, ACBT- postural drainage showed better acute effectiveness. It was impossible to forecast the patient's preference for a therapy technique.
Semwal et al. 2015	AD vs Oscillatory PEP therapy	30	There was no statistically significant difference observed in sputum weight and volume, dyspnea, oxygen saturation, or peak expiratory flow between the two treatment methods. When comparing the comfort Visual analogue scale Visual analogue scale scores, a statistically significant difference was seen, with most patients expressing that they felt comfortable playing Acapella. It was discovered that Acapella and Autogenic Drainage were equally successful in helping bronchiectasis patients discharge their phlegm.

4. Discussion

According to King et al study (5), cough, exhaustion, and dyspnea are three of the main clinical signs of bronchiectasis; hence, a decrease in these symptoms is advantageous. Therefore, even when taken for a brief period of time, limited PEP treatment, and expiration with glottis open in infralateral decubitus position led to improvement in cough-related quality of life (14). This is true even if the fundamental assumptions behind each of these strategies vary. While the primary mechanism of oscillatory PEP therapy involves a splinting effect on the airways to improve collateral ventilation and alter sputum rheology, the physiological basis for expiration with glottis open in infralateral decubitus position is proposed to be the promotion of two-phase gas-liquid interaction to facilitate mucociliary clearance (15). On the other hand, AD depends on the creation of shearing forces brought about by airflow at various lung volumes in order to mobilize and release secretions (16). This implies that the use of PEP treatment, or expiration with glottis open in infralateral decubitus position may, in the near term, result in more effective expectoration, independent of the approach used. However, improvement in this area of quality of life could only be sustained with ongoing care if there is no persistent improvement after the washout period between treatment approaches.

When PEP treatment was used in place of other methods, such as ACBT with GAD, the degree of dyspnea did not increase (10–12). This may be connected to the method using these approaches, which includes breathing control sessions, even if it isn't mentioned explicitly (17). On the other hand, oscillatory PEP with a Flutter may be less taxing on fatigued

individuals than sitting ACBT (10). It's unclear why this is the case considering that both approaches are performed while seated. It's probable that more breathing control was applied when using ACBT, but this conclusion should be read cautiously as there isn't a detailed description of the PEP treatment.

According to the findings of the study by Saurabh et al., autogenic drainage and ascapella were equally successful in clearing phlegm both immediately and ten minutes after therapy. The two methods did not significantly differ from one another. This might be because forceful expiratory effort is necessary for efficient sputum evacuation in both procedures. Patients with lower elastic recoil pressure had poor mucus clearance by forced expiration, according to a research by Schans et al. (18) bronchiectasis is characterized by decreased mucus transport and peripheral bronchiole breakdown. Patterson et al. found similar results in their trial of twenty patients with bronchiectasis, in which they contrasted Acapella with an active cycle of breathing approach (11). Savci et al.'s study, which compared the Autogenic drainage technique with the Active cycle of breathing approach on thirty COPD patients, found no statistically significant differences in sputum clearance, pulmonary function tests, or other parameters (19).

The study by Saurabh et al. revealed a noteworthy distinction in favor of Acapella vs autogenic drainage. This may be due to the fact that AD necessitates a great deal of patient participation in order for them to learn how to breathe at various flows. The patient with AD has to work on developing the skill of feeling or hearing the secretions in their chest. Consequently, the fact that Acapella is simple to use might be the reason why patients favored it (20).

In Eaton et al., 2007 study, although 44% of respondents said they preferred Flutter, there was no statistically significant difference in their preferences for any other approach. Eleven out of seventeen participants in a previous Flutter research said they preferred the Flutter over ACBT (17). In Patterson et al.(11) study the Acapella, a comparable gadget, was rated as the device of choice by 14 out of 20 participants. Age did not affect choice, despite the possibility that an older population might have a lower preference for gadgets. The mean age in our Eaton et al., 2007 study was quite similar to that of other studies by Flutter (17) and Acapella (11). Preferred treatment was not predicted by ACBT-postural drainage's advantage in terms of acute efficacy. The absence of sinus or reflux symptoms did not help, even though there are anecdotal reports that these individuals have trouble tolerating PD. On the other hand, ACBT- postural drainage administered under "optimal" standardized supervised settings could be more well-tolerated and not quite similar to the domiciliary context. Preference was not predicted by either the subjective or objective assessment of treatment length. Nonetheless, Flutter's perceived utility and performability were predicted. Similarly, preference for ACBT versus ACBT- postural drainage was predicted by the belief that ACBT interfered less with day-to-day activities (10).

Abbreviations

- GAD, gravity-assisted drainage
- PEP, Positive expiratory pressure
- ACBT, Active cycle of breathing technique
- HRCT, high-resolution computed tomography
- AD, autogenic drainage
- ACTs, airway clearance techniques

5. Conclusion

When given in a stable clinical condition or during an acute exacerbation, PEP treatment appears to have similar effects to other ACTs on symptoms of dyspnea, health related QOL, and sputum expectoration. Since bronchiectasis is a chronic condition, more research is required to determine the long-term clinical benefits of PEP therapy over other ACTs for outcomes that matter to bronchiectasis patients, as well as for clinical parameters that affect patient morbidity and the course of the disease in those with stable bronchiectasis.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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