Effectiveness of Airway Clearance Techniques in Bronchiectasis Management

[1]Ahmad Alessa, [2]Badr Allehyani, [3]Ghufran GhouthAli, [4]Nezar Filfilan, [5]Kalthoum Barnawi, [6]Shams Almaqati, [7]Ali Alqarni, [8]Ammar Baalkhir, [9]Shereen Alemam, [10]Faris Altuwairqi, [11]Moayad Bsooki, [12]Ali Alanazi, [13]Mohammad Tariq Ismail,

[1]alessarrt@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia

[2]Kamc206130@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia

[3]ghofranqadi@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

4nezar.filfilan@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[5]kalthoum.barnawi@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[6]Almaqati97@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[7]AliAlqarnix9@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[8]Ammar_bal@hotmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[9]alemamsh906@gmail.com,Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[10]altuwairqif@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[11]Mbsooki@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[12]aliasheq2@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

[13]RT.IsmailM@gmail.com, Respiratory Specialist, Respiratory Therapy Administration, King Abdullah Medical City, Makkah, Kingdom of Saudi Arabia.

Abstract

Bronchiectasis is a lung disease, the prevalence of which is increasing. Due to its huge burden on society, it is imperative to work on effective treatment strategies, such as airway clearance techniques (ACTs), which are among the most commonly used techniques. Online databases, including Google Scholar and PubMed, were searched. Articles published within the last five years in English were included in the search. Overall, five articles were included in the study. The results showed that ACTs in different forms, including huffing, exercise, the active cycle of breathing technique, the use of instrumental strategies, chest physiotherapy with or without saline nebulization, positive expiratory pressure, and the ELTGOL (L' Expiration Lente Totale Glotte Ouverte en decubitus Lateral) technique, are significantly effective in dealing with the problem of bronchiectasis, including the problems associated with acute exacerbation of bronchiectasis and non-cystic fibrosis bronchiectasis. The ACTs are effective in managing bronchiectasis. Bubble-positive expiratory pressure has been reported as the most effective among the different ACTs.

Keywords- Airway Clearance, Bronchiectasis Management

1.0. Introduction

Bronchiectasis is one of the progressive lung diseases that is characterized by persistent respiratory infections, abnormal bronchial dilation, and recurrent exacerbations [1-3]. Among the different clinical symptoms of bronchiectasis are chronic cough, hemoptysis, sputum production, and breathing problems and airway blockage, if the condition is not effectively managed [3]. However, the disease severity, etiology, symptoms, and prognosis may vary significantly among patients [1, 4]. Nevertheless, patients with bronchiectasis experience problems in excretion of secretions from the lower airways, resulting in increased risks of infection and inflammation because of abnormal bacterial growth [3]. This disease can be associated with different pathological conditions, including chronic obstructive pulmonary disease (COPD), autoimmune conditions, asthma, fungal infections, tuberculosis, and genetic disorders. However, the causal factors associated with this disease are still not clear in approximately 40% of patients [5]. The prevalence of bronchiectasis has been found to be increasing in the world, which is placing a huge burden on not only patients and their families but also on communities and health care systems [3].

Considering the symptoms and conditions of bronchiectasis, the objectives of its treatment include the improvement of symptoms as well as the quality of life of patients while preventing respiratory exacerbations and slowing down disease progression [1]. However, this disease has been reported as one of the neglected diseases [5], for which evidence-based therapeutic strategies still require more work [1]. The current guidelines for the management and treatment of this condition are mostly based on weak evidence related to small-scale studies [5].

Even though high-quality evidence to manage bronchiectasis is still required, recommended strategies are those related to minimizing damage to the airways in the body through the improvement of airway clearance and reduction of infection and inflammation [1]. In this regard, airway clearance techniques (ACTs) have been found to be the most prominent management or treatment strategies for improving mucus clearance and decreasing exacerbations [5]. Moreover, the ACTs can be developed according to the personalized factors of patients to improve clinical outcomes. However, it seems imperative to note that the use of ACTs has been investigated in the context of different lung diseases the use of this intervention in the context of bronchiectasis still requires more work [1]. The purpose of this scoping review is to discuss the effectiveness of ACT in bronchiectasis management.

2.0. Methods

The present study is based on a scope analysis for the study of empirical research findings regarding the effectiveness of ACT in bronchiectasis management. The scoping review is typically developed based on the main points extracted from the existing literature related to the topic under consideration [6]. The methodology used in the present scoping review consists of the following characteristics:

Scoping Horizon:

The studies published during the past five years, ranging from 2020 to present, were considered in the present scoping review so that the most recent knowledge would be obtained regarding the topic under study.

Databases Used:

Google Scholar and PubMed were used to find closely related articles.

Inclusion Criteria

The peer-reviewed empirical studies published in English during the years from January 1, 2020, to present dealing with the topic of the effectiveness of ACT in bronchiectasis management were considered.

Exclusion Criteria

Literature reviews and conference abstracts were not included in the study. Moreover, studies published before January 1, 2020, were excluded.

Number of Studies:5

3.0. Results

The clinical outcomes associated with the effectiveness of ACT in bronchiectasis management have been discussed in varying dimensions. Nonetheless, it is imperative to consider that Google Scholar has helped in retrieving 4 researches [7-10],

and PubMed has been found beneficial in retrieving 1 research [11], as shown in Figure 1.

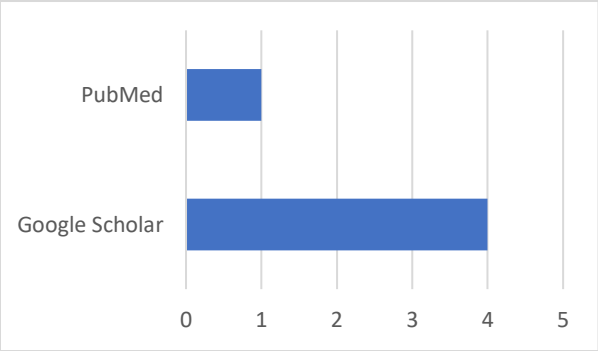

Figure 1: Count of Databases

The studies utilized different study designs. One of the studies is a survey study [7], one is an observational prospective cohort study [8], and three are randomized trials [9-11], as shown in Figure 2.

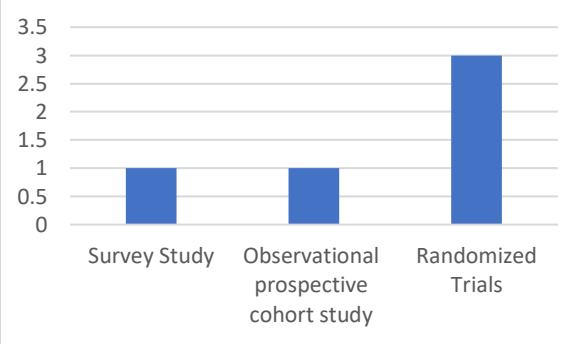

Figure 2: Count of Study Design

The studies also vary, considering the condition of bronchiectasis. One study was associated with the management of acute exacerbations of bronchiectasis [7], one was associated with bronchiectasis [8-10], and one was associated with non-cystic fibrosis bronchiectasis [11].

The studies also vary, considering the types of ACTs used. Among the different types of ACTs in the included studies were huffing, exercise, [7] the active cycle of breathing technique [7, 9, 10]; the use of instrumental strategies, including Flutter, Aerobika, Acapella, high frequency chest wall oscillation instrument, and lung flute [8], chest physiotherapy with or without saline nebulization [11], positive expiratory pressure [7, 9], and ELTGOL (L' Expiration Lente Totale Glotte Ouverte en decubitus Lateral) technique [10].

The studies also included patients of different ages, including pediatrics [7], children and adolescents [7, 11], and adults [7-10].

According to Phillips, Lee [7], the effectiveness of ACTs is reportedly different considering the types of ACTs. Among the pediatric patients, direct huffing and percussion have been found to be the most effective ACTs, as reported by 100% of the participants, though positive expiratory pressure with the help of a mouthpiece or mask has also been found effective, as reported by 93% of the participants. Among the adult patients, physical exercise has been found to be effective, as reported by 100% of the participants, though oscillating positive expiratory pressure devices and directed huffing have also been effective, as reported by 97% and 95% of participants, respectively [7].

Basavaraj, Choate [8] reported that the use of ACTs can be considered in the case of exacerbations, but it may not be significantly associated with the improvement in pulmonary function in the adult population. However, intermittent use of ACTs has been found to be more effective as compared to continuous use of ACTs, as it has decreased the odds of exacerbation [8].

Santos, Milross [9] reported that the bubble-positive expiratory pressure technique and the active cycle of breathing technique are both effective in treating bronchiectasis through sputum clearance. Their effectiveness has been found to be significantly better than that of control participants who were asked to sit. Moreover, they reported that the bubble-positive expiratory pressure technique was significantly better than control at all time points of the study (30 minutes and 60 minutes after intervention, $p < 0.05$), and it was better than active cycle of breathing technique at 60 minutes after intervention ($p < 0.05$) [9].

Pednekar and Gaikwad [10] reported that ACTs were significantly effective in improving the pulmonary abnormalities, quality of life of patients, and exercise capacity. However, further analysis showed that both the ELTGOL technique and the active cycle of breathing techniques were insignificantly different regarding effectiveness in the context of bronchiectasis management ($p = 0.607$

before intervention, and p = 0.935 after intervention) [10].

Anuradha, Gunathilaka [11] reported the use of conventional ACTs consisting of chest physiotherapy with or without saline nebulization. They found that even though ACTs were effective in improving forced expiratory volume in one second (FEV1) and predicted forced vital capacity (FVC), and reducing the number of exacerbations, the combination of 3% hypertonic saline with ACT was significantly effective in the context of these outcomes ($p < 0.05$) [11].

4.0. Discussion

This scoping review has been conducted with the purpose of assessing the effectiveness of ACT in bronchiectasis management. The literature search showed that ACTs in different forms have effective outcomes associated with pulmonary function (such as that associated with FEV1 and FVC), quality of life, and exercise capacity.

Considering the different forms of ACTs, physical exercise, directed huffing, chest physiotherapy, and active cycle of breathing techniques are among the most commonly used techniques [11-13]. All these techniques have been found effective [7], and the active cycle of breathing techniques and huffing have additional benefits in that they may not require any additional tools and can be completed in different conditions [7, 14]. Moreover, the active cycle of breathing techniques has been found effective in sputum expectoration as compared to other conventional ACTs of postural drainage [15]. This technique can further be improved by adding hypertonic saline in the intervention [11] that is also supporting the previous findings on the use of hypertonic saline solutions [16].

The ELTGOL technique and active cycle of breathing techniques have been equally effective in the present review. This finding has also been supported by previous studies [10, 17]. Bellone, Lascioli [18] also reported that the ELTGOL technique can help in significantly improving the BCSS score, which can effectively measure breathing, coughing, and sputum production among patients and has been used by researchers to assess relief from disease [19-22]. However, in comparison to the active cycle of breathing techniques, the bubble-positive expiratory pressure technique can be a preferred technique [9]. This is because the bubble-positive expiratory pressure technique can produce oscillation frequencies that are optimal to produce airway secretion clearance [23, 24]. Nevertheless, the effectiveness of the bubble-positive expiratory pressure technique has been found to be similar to the use of instrumental strategies, including Flutter and Acapella [9, 25], which have been found effective in sputum expectoration [26-28]. On a further note, the Flutter has been found to be better in terms of reducing sputum viscosity [29, 30]. The use of these instruments has also been reported in the present scoping review, though it seems imperative to use these interventions intermittently [8]. Consequently, it is important to note that even though ACTs have been found effective in bronchiectasis management, their effectiveness can also be altered based on several factors, such as medical staff training and preferences [12].

The limitations of this scoping review have to be considered for clinical implications. For instance, this scoping is based on fewer empirical studies. In the future, more studies can be considered in the reviews or large-scale empirical studies can be conducted for a clearer interpretation of findings. Another limitation of this study is that it has not been focused on trials comparing ACTs with other forms of interventions, thereby showing that the issue clearly defines outcomes in favor of ACTs. Nevertheless, the findings of this review can be used in clinical settings, as only empirical studies were included in this review that focused on ACTs.

5.0. Conclusion

The ACTs have been found effective in the management of bronchiectasis. However, different forms of ACTs may show differences in outcomes. For instance, physical exercise, directed huffing, and active cycle of breathing techniques are commonly used techniques, but it would be better to use active cycle of breathing techniques, which are also similar in effectiveness to the ELTGOL technique. In comparison to these techniques, bubble-positive expiratory pressure is more effective, and this effectiveness can be compared to the outcomes

associated with the use of instrumental strategies, including Flutter and Acapella.

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