

EFFICACY OF ACTIVE CYCLE OF BREATHING TECHNIQUE AND POSTURAL DRAINAGE IN PATIENTS WITH BRONCHIECTESIS - A COMPARATIVE STUDY

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ABSTRACT

Back Ground and Objective: Bronchiectasis is one of the most common diseases in the rural and industrial areas of India. The most accepted treatment protocol preferred for Bronchiectasis now days includes oral, aerosolized or intravenous antibiotic therapy according to the severity of the exacerbation and mucus clearance by means of bronchial hygiene assistive devices, surgical resection, chest physiotherapy like breathing exercises, postural drainage, high-frequency chest compression, forced expiratory techniques etc. Active cycle of breathing techniques (ACBT) is also the standard airway clearance technique used in patients with bronchiectasis. So this study is intended to know and compare the effectiveness of ACBT and Postural drainage techniques as a means of treatments in patients with bronchiectasis.

Methodology: It was a Randomized experimental study with 30 subjects who satisfied the inclusion criteria with a mean age group of 44 were selected for the study. All the subjects were explained about the procedures and need of the study. 15 subjects were randomly assigned under Postural Drainage group and 15 were randomly assigned under ACBT group. Pre and Post evaluation were done with FVC, FEV₁, PEFr and SPO₂ by using Pulmonary Function Test and Pulse Oxymetry.

Results: Paired 't' test was performed for the analysis of data. Very high significant result was shown in efficacy of ACBT and Postural Drainage in improving FVC, FEV₁, PEFr and SPO₂. ACBT found to have very high significance in the efficacy compared to postural drainage with P < 0.05 in the management of patients with Bronchiectasis.

Conclusion: Even though both Postural drainage and ACBT have significant effect in clearing airways and thereby improving pulmonary function in bronchiectasis, Active cycle of breathing technique has a better effect in clearing the airways than postural drainage and thereby improving pulmonary function in patients with bronchiectasis.

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INTRODUCTION

Bronchiectasis is one of the most common diseases in the rural and industrial areas of India. There are reports of high prevalence in relatively isolated populations with poor access to health care and high rates of respiratory tract infections during childhood [1]. Bronchiectasis is an abnormal dilatation of the bronchi associated with obstruction and infection [2]. Clinically, Bronchiectasis is defined as an abnormal dilatation of medium size bronchi and bronchioles (about the fourth to ninth generations), generally associated with previous, chronic necrotizing infections within these passages [3]. The etio-pathogenesis of Bronchiectasis is related to bronchial obstructions, infections or both in a large majority of patients [4]. The condition most commonly affects the lower lobes, the lingula and then the middle lobe. It tends to affect the left

lung more than right, although 50% of cases are bilateral [2]. It is an uncommon disease with the potential to cause devastating illness including repeated respiratory infections requiring antibiotics, disabling productive cough, shortness of breath, and occasional haemoptysis [5].

Typical signs & symptoms include; Sputum overproduction, Fever, Pleurisy, Dyspnoea, Chronic cough, Haemoptysis, Added sounds, Clubbing. Pulmonary function test of patients with localized bronchiectasis show reduction in FEV₁, maximal mid expiratory flow rate, Maximal voluntary ventilation (MVV), diffusing capacity and increase in residual volume [3]. Spirometry often shows a limitation of airflow with a reduced ratio of forced expiratory volume in one second (FEV₁) to forced vital capacity (FVC), a normal or slightly reduced FVC, and a

reduced FEV₁. A reduced FVC may indicate that airways are blocked by mucus, which collapse with forced exhalation or there is pneumonitis in the lung [6]. High-resolution CT has become the best tool for diagnosing bronchiectasis, clarifying the findings from chest radiography and mapping airway abnormalities that cannot be seen on plain films of the chest [7]. The invention of Broad spectrum antibiotics in this era has lessened the mortality and morbidity rate in respiratory infective diseases. The most accepted treatment protocol preferred for Bronchiectasis now days includes oral, aerosolized or intravenous antibiotic therapy according to the severity of the exacerbation and mucus clearance by means of bronchial hygiene assistive devices, surgical resection, chest physiotherapy like breathing exercises, postural drainage, high-frequency chest compression, forced expiratory techniques etc [8].

Enhancing the removal of respiratory secretions in patients with bronchiectasis is beneficial [9]. Physical means such as gravitational postural drainage and the forced expiration technique (FET) used for chest physiotherapy may also be effective [10]. In addition to the control of cough, postural drainage, chest physiotherapy, thinning and loosening of secretions, the administration of a bronchodilator and of inhaled corticosteroids has been a part of maintenance therapy and treatment for acute exacerbations [11]. ACBT could an effective method of airway clearance technique in Bronchiectasis and it is effective in cleaning secretions and improving lung functions. These techniques can be used in stable COPD patients according to the patient's and the physiotherapist's preferences [12, 13].

Pulmonary Function Test, Oxygen saturation and Peak Expiratory Flow Rate can measure the effects of postural drainage and Active Cycle of Breathing Techniques. Monitoring Pulmonary Function Test provides a guide to the state and function of the respiratory system. It indicates the forced expiratory volume in one second (FEV₁), vital capacity, forced vital capacity, the peak expiratory flow rate and oxygen saturation (SPO₂) which are used as means of monitoring the effects of postural drainage and active cycle of breathing techniques in bronchiectasis [14].

There is not enough evidence to support or refute the use of bronchial hygiene physical therapy in patients with chronic obstructive pulmonary disease and bronchiectasis. Considering the above factors, the need arises to examine the effects of broncho-pulmonary hygiene physical therapy and to compare the efficacy of active cycle of breathing technique versus postural drainage in the management of patients with bronchiectasis to know which technique is more effective for patients with Bronchiectasis.

MATERIALS & METHODODOLOGY:

It was a Randomized Experimental Study. The study included a sample of 30 patients with age group

between 30 to 60 yrs. The subjects were diagnosed as bronchiectasis by Pulmonologist or Physicians based on their clinical findings, irrespective of their sex. The diagnosed cases of bronchiectasis were taken from JSS Medical College Hospital, Mysore, Govt. Chest and TB Hospital, Mysore and Justice K.S Hegde Charitable Hospital, Mangalore.

Inclusion Criteria were diagnosed cases of isolated Bronchiectasis, Age between 30 – 60 yrs, both males and females. The exclusion Criteria were; conditions with symptoms of raised intra cranial pressure, Head and neck injury until stabilized, Active haemorrhage with hemodynamic instability, Recent spinal surgery (e.g., laminectomy) or acute spinal injury, active haemoptysis, Empyema, Broncho pleural fistula, Pulmonary oedema associated with congestive heart failure, Large pleural effusions, pulmonary embolism, Aged, confused, or anxious patients who do not tolerate position changes, Rib fracture, with or without flail chest, Tumours, Active cases of tuberculosis.

The subjects were explained about the treatment, experimental procedures, and outcome measures. Formal written consent was obtained from each subject and ethical clearance was obtained from Institutional Ethical Committee of Nitte Institute of Physiotherapy. The selected 30 subjects were then randomly assigned to any of the two experimental treatment groups i.e. Group A and Group B of 15 subjects each. Group A, received Active cycle of breathing technique for 15 - 20 minutes. Each standardized ACBT cycle lasted around two minutes. During the study the total number of ACBT cycle performed during the treatment phase was individualized and not set. Three treatment sessions in a day were given with an interval of four hours between each session. Total study period was for eight hours. ACBT was administered to the affected lobe after explaining the procedure to the patients. Group B, have received postural drainage for 15 – 20 minutes. Three treatment sessions in a day were given with an interval of four hours between each session. Total study period was for eight hours and traditional postural drainage procedures were given to the affected lobes. The outcome tools used in the study were Pulmonary Function Test to measure Force Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV₁) and Peak Expiratory Flow Rate (PEFR) and Pulse Oxymetry was used to measure SPO₂, which were done before administering the treatment and at the end of treatment for both the groups.

RESULTS

The data of the two techniques (ACBT & PD) used in treating diagnosed cases of bronchiectasis were analysed by using paired't' test. In the data, The Mean, Standard Deviation and Standard Error in pre and post test of active cycle of breathing technique and Postural drainage was obtained.

Table-1 Mean, Standard Deviation And Standard Error In Pre And Post Test Of Active Cycle Of Breathing Technique

| VARIABLE | PRE-TEST | | | POST -TEST | | |
|------------------|----------|------|------|------------|------|------|
| | MEAN | SD | SE | MEAN | SD | SE |
| FVC | 2.61 | 1.41 | 0.36 | 3 | 1.53 | 0.39 |
| FEV ₁ | 1.75 | 0.92 | 0.23 | 2.29 | 1.11 | 0.28 |
| PEFR | 4.87 | 0.81 | 0.21 | 5.63 | 0.94 | 0.24 |
| SPO ₂ | 93.1 | 2.09 | 0.54 | 97.4 | 1.72 | 0.44 |

Table-2 Mean, Standard Deviation And Standard Error In Pre And Post Test Of Postural Drainage (Pd)

| VARIABLE | PRE-TEST | | | POST -TEST | | |
|------------------|----------|------|------|------------|------|------|
| | MEAN | SD | SE | MEAN | SD | SE |
| FVC | 2.7 | 1.4 | 0.36 | 2.9 | 1.4 | 0.36 |
| FEV ₁ | 1.8 | 0.87 | 0.22 | 2.16 | 0.93 | 0.24 |
| PEFR | 5.15 | 0.61 | 0.16 | 5.57 | 0.72 | 0.58 |

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| | | | | | | |
|------|----|------|------|------|------|------|
| SPO2 | 94 | 2.26 | 0.58 | 96.1 | 1.92 | 0.49 |
|------|----|------|------|------|------|------|

Table-3comparison Of Pre And Post Test In Active Cycle Of Breathing Technique

| VARIABLE PRE-POST | MEAN DIFFERENCE | T-VALUE | P-VALUE & RESULT |
|-------------------|-----------------|---------|------------------|
| FVC | -0.38 | -10.27 | 0.000 P<0.05 VHS |
| FEV1 | -0.54 | -9.97 | 0.000 P<0.05 VHS |
| PEFR | -0.76 | -9.19 | 0.000 P<0.05 VHS |
| SPO2 | -4.33 | -16.03 | 0.000 P<0.05 VHS |

Table-4comparison Of Pre And Post Test In Postural Drainage

| VARIABLE PRE-POST | MEAN DIFFERENCE | T-VALUE | P-VALUE & RESULT |
|-------------------|-----------------|---------|------------------|
| FVC | -0.20 | -11.83 | 0.000 P<0.05 VHS |
| FEV1 | -0.27 | -9.27 | 0.000 P<0.05 VHS |
| PEFR | -0.42 | -7.83 | 0.000 P<0.05 VHS |
| SPO2 | -2.13 | -6.95 | 0.000 P<0.05 VHS |

Table-5improvement Comparison Between Active Cycle Of Breathing Technique And Postural Drainage

| IMPROVEMENT IN VARIABLE | MEAN DIFFERENCE | T-VALUE | P-VALUE & RESULT |
|-------------------------|-----------------|---------|------------------|
| FVC | 0.18 | 4.52 | 0.000 P<0.05 VHS |
| FEV1 | 0.266 | 4.47 | 0.000 P<0.05 VHS |
| PEFR | 0.34 | 3.45 | 0.002 P<0.05 VHS |
| SPO2 | 2.2 | 5.38 | 0.000 P<0.05 VHS |

The two techniques ACBT and PD used for airway clearance in bronchiectasis showed significant improvement in pulmonary function after the intervention of ACBT and PD and when pre- and post-treatment outcome measures within each group on the basis of improvement were compared using unrelated paired 't' test. (Table 1 to 4). And when the inter group comparison were done, the mean difference in FVC was 0.18 with T value being 4.52 with P < 0.05 showed that ACBT is having very high significance in clearing the airways in bronchiectasis when compared to postural drainage. In FEV1 the mean difference is 0.266 and T value 4.47 with P < 0.05 showed that ACBT is having very high significance in clearing the airways in bronchiectasis when compared to postural drainage. In PEFR the mean difference is 0.34 and T value 3.45 with P < 0.05 showed that ACBT is having very high significance in clearing the airways in bronchiectasis when compared to postural drainage. But when compared with other variables of Pulmonary Function Test for the improvement, PEFR shows less significant improvement as P value is 0.002. In SPO2 the mean difference is 2.2 and T value 5.38 with P < 0.05 showed that ACBT is having very high significance in clearing the airways in bronchiectasis when compared to postural drainage.

DISCUSSION

This was a comparative study between effectiveness of Active Cycle of Breathing Technique and Postural Drainage for improving pulmonary function in bronchiectasis patients. The results shows that, Active Cycle of Breathing Technique is having better effect on clearing the airways in bronchiectasis patients compared with postural drainage. The result of the study supports the hypothesis that there will be a significant effect in airway clearance in bronchiectasis patients using both Active cycle of breathing technique and postural drainage but when both the techniques are compared ACBT is having a better effect than Postural Drainage to improve pulmonary function in Bronchiectasis.

In a study by Patterson et al [12] in their article stated that, ACBT is a more effective method of airway clearance in bronchiectasis during single treatment sessions. Other study by Pryor et al [15] in their study stated that, a decrease in oxygen saturation caused by chest percussion may be avoided by using the ACBT technique. Similar findings were found in studies done by Savci S et al [16] who stated that ACBT is effective in cleaning secretions and improving lung functions in Bronchiectasis. The ACBT increased forced vital capacity, peak expiratory flow rate, arterial oxygenation and exercise performance.

This was evident through Arterial Blood gas analysis. These statements were proven right again in this study by comparing the pre and post ACBT intervention data which is showing a high significance difference with P < 0.05 in FVC, FEV₁, PEFR and SPO₂.

Majority of the patients selected in this study reported to have an earlier medical history of infective disease such as Tuberculosis, Post necrotizing pneumonia etc. Bronchiectasis is one of the most common types of COPD secondary to any other infective diseases. There was an earlier study done by E Silverman et al [8] who stated in their study that, known causative factors include post infection bronchial damage, post inhalation injury, hypersensitivity reactions, and congenital airway obstructive disorders.

One interesting observation made during this study was about the higher quantity of the secretion removed in the early morning treatment session compared with the other treatment sessions the patient had in the same day which may be because it is done for the first time after a gap of 8-10 hours of previous treatment session. This was also noted by Willy E. Hammon and Scot Hasson earlier [3]. As per the pathology stated by earlier researchers, that bronchiectasis usually affects the lower lobes of the lung, and mostly unilateral, same distribution of affection were observed in this study too. Majority of the cases selected for this study, that's nearly 65% were affected with unilateral bronchiectasis. The same findings were found in prior studies done by Willy E. Hammon and Scott Hasson stated Bronchiectasis usually localized in a few segments or in entire lobe of the lung. Most commonly, it is unilateral and effects basal segments of the lower lobes [3].

There are significant changes seen in FVC, PEFR and FEV1 in this study after the intervention of both ACBT and Postural Drainage in bronchiectasis and this findings were supported by J.A. Pryor [9] who stated that there is evidence of an improvement in lung function; including FEV₁, FVC and maximum expiratory flow rate at 25% and 50% of FVC following the instigation of the ACBT. In another study by Pryor JA & Webber BA [17] have stated that, ACBT has also been shown to be equally effective both with and without an assistant. In this study also same findings were found with ACBT which was highly effective and showed significant statistical improvement without an assistance. Meanwhile contradicting the findings of this current study there were some findings done by Cecins NM et al [18] who stated that there was no significant difference in oxygenation or lung function (FEV1) after

giving any of these treatments. And C S Thompson et al [19] concluded that there was no significant change in peak expiratory flow rate or in breathlessness (Borg score) after individual physiotherapy sessions with either techniques, where the methodology of the study was little different from the current study.

There was a very high significant improvement was noted when the effect of postural drainage alone was compared between pre to post test values on Bronchiectasis with a $P < 0.05$ in FVC, FEV1, PEFr and SPO2. The results of the study were supported by the same findings by Baseler F, Wilde J, Piellesch W [20].

Vincent Mysliwiec et al [21] in their study stated that bronchiectasis caused by infection tends to occur predominantly in middle-aged to elderly populations, while that associated with congenital defects is likely to occur in younger patients. This study was very well hold up with the above statement as majority (97%) of the population in this study was at an age group above 35 years. This factor is again supported by the earlier findings by Nicotra MB et al [6] in their study stated that the mean age at injury was found to be 20 years, the mean age at onset of symptoms was 39 years, and the age range with the highest frequency of bronchiectasis was 60 to 80 years [6]

In the current study we could recruit only 30 subjects which was very less for a study like this and is considered as a limitation of the study. There is a need for adequately sized, high-quality, randomized controlled trials with uniform patient populations to examine the effects of ACBT and Postural Drainage in Bronchiectasis. Further studies are recommended to find out the variations in the results of the variables such as FVC, FEV1, PEFr and SPO2. There are very little studies done with ACBT assisted by Physiotherapist and Independent ACBT without assistance. There are various other techniques used for broncho pulmonary hygiene but there is very less studies and evidences which prove its effectiveness. Hence further studies are suggested and encouraged to find out which is the best effective method of treatment for the management of Bronchiectasis.

CONCLUSION

Even though both ACBT and Postural Drainage techniques are found to have significant effect in clearing the airways, the Active cycle of breathing technique has a better effect than the postural drainage and thereby improving pulmonary function in patients with bronchiectasis.

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