



Original Research Article

## Autogenic Drainage versus Acapella for Airway Clearance in Patients with Bronchiectasis: Randomized Crossover Trial

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### ABSTRACT

Airway clearance techniques are the mainstay in treatment of patients with bronchiectasis. The objective of the study was to compare the efficacy of Autogenic drainage versus Acapella in patients with bronchiectasis. A total of thirty patients with stable bronchiectasis were recruited from National Institute of Tuberculosis and Respiratory Diseases and Guru Teg Bahadur Hospital, New Delhi. Patients were administered Acapella or Autogenic Drainage clearance technique in a random order and the other technique was given to the patient after a wash out period of 3 hours. All patients were compared at baseline, immediate and 10 minutes after intervention for the outcome measures. (Sputum volume, sputum wet weight, modified Borg's Scale for dyspnea, Respiratory rate, Oxygen Saturation, Peak expiratory flow rate) .Visual analogue scale(VAS) was used to measure the patients' perception of comfort of performing either of the technique. Sputum wet weight and volume, dyspnea, Oxygen Saturation; Peak Expiratory flow did not show statistically significant difference between the two treatment techniques. VAS score comparison for comfort showed a statistically significant difference with the majority of patients reporting comfort in performing Acapella. Acapella was found to be equally effective as Autogenic Drainage in sputum clearance in patients with bronchiectasis.

**Keywords:** Acapella, Autogenic Drainage, sputum, PEFr, SpO<sub>2</sub>, Bronchiectasis.

### INTRODUCTION

Bronchiectasis is a disease characterized by impaired mucociliary apparatus along with abnormal distention of bronchi. The impaired mucociliary apparatus leads to the vicious cycle of inflammation and increased mucus production. [1,2]

Airway clearance techniques form the mainstay of treatment along with antibiotics for the disease. Various

techniques like postural drainage with vibration, active cycle of breathing technique, autogenic drainage have been used in patients with bronchiectasis. Recently devices for respiratory physiotherapy have emerged as alternatives which are less time-consuming and offer greater independence to the patient with chronic lung disease. The devices of respiratory physiotherapy are: Positive Expiratory Pressure, High Frequency Chest

Wall Oscillation, flute, Intrapulmonary Percussive Ventilation, Flutter device, Acapella device etc. [3-5]

Autogenic drainage is a system of breathing techniques in which the patient has to breathe at different lung volumes to mobilize the secretions from the periphery of the lung field to the central airways from where it can be coughed/ huffed out.

Acapella is a small hand held device which incorporates the positive expiratory pressure and high frequency oscillation therapy. A laboratory based study found Acapella to be as effective as Flutter in terms of oscillation frequency and Acapella was better tolerated in patients with low expiratory flow. Another study highlighted that Acapella generates better amplitude of vibration as compared to water bottle which in turn may be useful for better secretion removal. Acapella was compared with Active cycle of breathing technique in patients with bronchiectasis and was found to be equally effective in sputum clearance. [6-8]

Autogenic drainage has been studied as a technique for sputum clearance in different pulmonary population like cystic fibrosis, COPD etc. The results of few studies have shown AD to be as effective as other technique used but in one study AD has found to be significantly more effective in sputum clearance in cystic fibrosis patients. [7]

Thus this study aims to compare the efficacy of Autogenic drainage and Acapella in patients with stable bronchiectasis and to determine the patients' preference between the two techniques.

## **MATERIALS AND METHODS**

**Patients:** Thirty patients aged between 30 - 60 years were recruited with history of productive cough with a diagnosis of bronchiectasis and one week of reformed period of smoking for the study from

National Institute of Tuberculosis and Respiratory Diseases (formerly known as Lala Ram Sarup Institute of Tuberculosis and Respiratory Diseases) and Guru Teg Bahadur hospital, New Delhi. Patients with any diagnosed active systemic infection, co-existing pulmonary pathology, cardiac, neurological and musculoskeletal disorders were excluded from the study. A sample size of 16 was calculated using sputum weight as the primary outcome with 90% as power,  $\alpha$  less than 0.05 and a two tailed test. The study was cleared by the Institutional Ethical Committee of National Institute of Tuberculosis and Respiratory Diseases (formerly known as Lala Ram Sarup Institute of Tuberculosis and Respiratory Diseases). Permission for data collection was obtained from the additional Medical superintendant of Guru Teg Bahadur hospital, Delhi.

**Study design:** Patients attending the respiratory / medicine clinic of the participating hospitals were evaluated for therapy after obtaining informed consent from them. The patients were recruited for either of the chest physiotherapy technique Acapella or Autogenic Drainage via concealed envelop method. After 3 hours of wash-out period the treatment technique were crossed over. Sputum volume, sputum wet weight, Peak expiratory flow rate, Modified Borg's scale for dyspnea, and oxygen saturation were recorded at baseline, immediate and ten minutes after treatment. Visual analogue scale for patient's preference for the technique was recorded 10 minutes after the therapy. The treatment was terminated if the patient's oxygen saturation fell more than 5% from the baseline, systolic blood pressure increased more than 139 mm hg and diastolic blood pressure more than 89 mm hg and on patients' discomfort. Peak expiratory flow rate was measured using the Ferraris Peak flow meter. Three efforts were allowed and best of three values was

considered for measurement. Oxygen saturation was measured using Nidex fingertip pulse oxymeter model 6500. The weight of sputum expectorated was measured using calibrated electronic balance (MH-Series Scale, model 200) accurate to 0.01 g. The wet sputum volume was measured using calibrated measuring cups under all universal precautions. The sputum was disposed of as per the infection control regulations of the respective hospital.

**Autogenic drainage:** The patient was made to sit and instructed to breathe at different lung volumes starting with low lung volumes. A series of 10 – 20 breaths at low lung volumes was encouraged till the secretions were auscultated. Cough / huff were not encouraged at this phase. Then the patient was asked to breathe at normal at tidal volume followed by for 10 – 12 breaths followed by breathing near the vital capacity followed by cough. The technique was given for 20-30 minutes in total depending on patients' requirements.

**Acapella:** The patient was made to sit and instructed to breathe 10-12 times using Acapella. Each inspiration was followed by a 2- 3 seconds hold and exhalation. Cough or huff was performed after every 10 breaths. The technique was given for 20 –

30 minutes in total depending on patients' requirements.

**Statistical analysis:** The statistical package of social sciences (SPSS) for windows version 19.0 was used to analyze the data. Independent .t -test was done to compare the effects of both the interventions on the outcome measures. Statistical significance was set at  $p \leq 0.05$ .

## RESULTS

The total of thirty completed the study. There were twenty males and ten females with mean age of  $46.20 \pm 9.26$  and  $49.30 \pm 9.96$  respectively (Table: 1)

**Table 1: Demographic details of the sample**

N=30	Male	Female
Age (years)	$46.20 \pm 9.26$	$49.30 \pm 9.96$
Smoking (number of Years)	$13.50 \pm 10.68$	0

No statistically significant difference was found between the sputum wet weight and volume, dyspnea scores, oxygen saturation and peak expiratory flow rate in Autogenic treatment and Acapella treatment. Patient preference for the treatment technique was significantly different between Autogenic drainage treatment and Acapella treatment.

**Table:2-Comparision of Immediate effect between Acapella and Autogenic Drainage**

Variable Immediate	Acapella	Autogenic Drainage	t	P
Sputum Vol.(ml)	$16.33 \pm 10.3$	$16.10 \pm 7.94$	0.09	0.92
Sputum Weight(gms)	$16.16 \pm 7.94$	$15.83 \pm 5.73$	0.18	0.85
Dyspnea (Modified Borg Scale)	$1.80 \pm 1.09$	$1.80 \pm 1.21$	0.00	1.00
SPO <sub>2</sub> (%)	$97.03 \pm 2.12$	$96.93 \pm 1.94$	1.90	0.85
PEFR (ml)	$176.10 \pm 72.62$	$179.10 \pm 72.55$	-0.15	0.87

SpO<sub>2</sub>: Oxygen saturation PEFR: Peak expiratory flow rate ml: milliliter gms : grams

**Table 3: Comparison of 10 minutes post intervention effect between Acapella and Autogenic Drainage.**

Variable 10 min Post	Acapella	Autogenic Drainage	t	p
Sputum Vol.(ml)	$16.40 \pm 10.40$	$16.33 \pm 8.38$	0.02	0.97
Sputum Weight(gms)	$16.20 \pm 7.992$	$16.06 \pm 6.020$	0.07	0.93
Dyspnea (Modified Borg Scale)	$1.73 \pm 1.04$	$1.77 \pm 1.22$	-0.11	0.91
SPO <sub>2</sub> (%)	$97.37 \pm 2.00$	$97.33 \pm 1.82$	0.06	0.94
PEFR (ml)	$178.80 \pm 75.67$	$179.00 \pm 72.65$	-0.01	0.99

SpO<sub>2</sub>: Oxygen saturation PEFR: Peak expiratory flow rate ml: milliliter gms: grams

**Table 4: Comparison of patient preference scale between Acapella and Autogenic drainage**

Variable	Acapella	Autogenic Drainage	T	p
Patient Preference Scale (VAS)	6.87±1.22	5.77±1.10	3.65	0.001*

\* Significant difference

## DISCUSSION

This present study compared the effect of sputum clearance device (Acapella) versus Autogenic Drainage for sputum clearance in patients with Bronchiectasis.

In this study there were total of thirty patients out of whom eighteen were known smokers and two had no history of smoking.

All outcome variables viz sputum weight, sputum volume, modified Borg's scale for dyspnea, respiratory rate, SPO<sub>2</sub>, Peak Expiratory Flow Rate were recorded at baseline, immediate after therapy and 10 minute post therapy for both Acapella and Autogenic Drainage. Heart rate and blood pressure was monitored throughout treatment session for patient safety. Patient preference for the technique was evaluated by visual analogue scale.

The results of the present study showed that Autogenic drainage and Acapella were found to be equally effective in sputum clearance immediately and ten minutes post therapy. There was no significant difference between the two techniques. This may be due the fact that in both the techniques forced expiratory effort is required for effective sputum clearance. Schans et al have stated in their study that mucus clearance by forced expiration is impaired in patients with reduced elastic recoil pressure. [9] Bronchiectasis is a disease state characterized by impaired mucus transport and destruction of peripheral bronchioles. [1,2] Similar results were observed by Syed et al in bronchiectasis patients. [10]

Similar findings have also been observed by Patterson et al in their study on twenty bronchiectasis patients in whom they had compared active cycle of breathing technique with Acapella. [11] A study done

by Savci et al on thirty patients with COPD compared Autogenic drainage with Active cycle of breathing technique also showed no statistical difference in terms of sputum clearance, pulmonary function test etc. [12]

The present study showed a significant difference in preference for Acapella over autogenic drainage. This might be because of the fact that AD requires a lot of patients' cooperation for learning the technique of breathing at different flow. Secondly the patient needs to practice the art of hearing the secretions or feel the chest secretions in AD. Thus this may be the reason that patients had a preference for Acapella as it is easy to operate. [6]

## CONCLUSION

This study concluded that both the techniques Acapella and Autogenic drainage are equally effective for sputum clearance in patients with bronchiectasis. The choice of the technique should be decided on the patients comfort level for administering the techniques.

**Declaration of interest:** The authors report no conflict of interest.

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