

*Case Report***Effectiveness of Lung Flute - An OPEP Device for Bronchial Hygiene in a Patient with Cystic Bronchiectasis: A Case Report**Dangi Ashwini¹, Deo Medha²¹Associate Professor, ²Principal,
Terna Physiotherapy College, Terna Medical College Campus, 3rd floor, Sector 12, Nerul, Navi Mumbai.

Corresponding Author: Dangi Ashwini

*Received: 09/03/2015**Revised: 09/04/2015**Accepted: 11/04/2015***ABSTRACT**

The most important functional finding in cystic bronchiectasis is severely impaired clearance of secretions from the bronchial tree leading to increased chances of pulmonary infections. Various positive pressure devices are widely used as an adjunct to the conventional chest physical therapy for the mobilisation and clearance of bronchial secretions. In this case report, we describe the treatment of a patient with cystic bronchiectasis using Lung Flute device.

A 73 year old male, was admitted with symptoms of dyspnoea on exertion and cough with copious expectoration. His chest radiograph revealed honeycomb appearance in bilateral upper lobes and fibro – bronchiectatic changes in anterior and medial basal segment of right lower lobe. He found it difficult to clear chest secretions despite aggressive, routine chest physical therapy. He was given a 10 days trial of Lung Flute - a hand-held oscillatory positive expiratory pressure (OPEP) therapy device for facilitating airway clearance. A marked reduction was noted in the sputum volume from the 1st to the 10th day of the trial. There was a reduction in the dyspnoea score on the MRC scale. An improvement was also seen in the Leicester Cough Scale score. Lung Flute device was easy to use and helped in the optimal secretion clearance in this case. This case report highlights the benefits of Lung Flute device in achieving an effective bronchial hygiene in cystic bronchiectasis patients.

Key Words: Bronchial hygiene, Cystic bronchiectasis, Lung Flute, Oscillatory positive expiratory pressure devices.

INTRODUCTION

Bronchiectasis is a disease that results in abnormal and permanent dilatation and distortion of the proximal and medium – sized bronchi caused by weakening or destruction of the elastic and muscular components of the bronchial wall. Cystic bronchiectasis is a type of bronchiectasis with a ballooned appearance of bronchi with air - fluid levels and large cystic areas in the

lungs with a honeycomb appearance. It is regarded as a common disease in the developing countries. ^[1] In India, the incidence of bronchiectasis is still quite high because of the lack of adequate treatment of acute pulmonary infections. ^[2] Bronchiectasis is the major cause of morbidity and mortality in patients.

The most important functional finding of altered airway anatomy is

severely impaired clearance of secretions from the bronchial tree. Impaired clearance of secretions causes colonization and infection with pathogenic organisms, contributing to the purulent expectoration commonly observed in patients with bronchiectasis. The result is further bronchial damage and a vicious cycle of bronchial damage, bronchial dilation, impaired clearance of secretions, recurrent infection, and more bronchial damage. [3]

Chest physical therapy plays an integral role in the treatment of cystic bronchiectasis. Various positive pressure devices are widely used as an adjunct to the conventional chest physical therapy for the mobilisation and clearance of bronchial secretions. [4-6] These devices have been designed to enhance patient's compliance and independence for secretion clearance. Lung Flute is one such device which is a hand – held oscillatory positive expiratory pressure device which facilitates mucus clearance. It is non – invasive, easy to use and drug – free which helps in secretion clearance. Very limited literature is available about Lung Flute and hence more studies are needed in this direction. In this case report, we describe the treatment of a patient with cystic bronchiectasis using Lung Flute device.

CASE REPORT

A 73 year old male patient, retired taxi driver, was admitted with symptoms of dyspnoea on exertion and cough with copious mucopurulent expectoration lasting for 2 weeks. The dyspnoea was progressively increasing making it difficult for the patient to perform his daily activities. The patient also complained of frequent bouts of coughing along with expectoration of yellowish sputum which was mainly in the early morning and with positional changes. The patient had a past history of chronic cough with expectoration, increased

during seasonal changes. On admission, chest x ray was done which revealed hyperlucency and honeycomb appearance of the lower lobes along with cystic changes of both the lungs. His oxygen saturation at rest was fluctuating, dropping down to 80% whenever patient had difficulty in expectorating. Patient had a previous PFT report which suggested a mixed obstruction with good reversibility post – bronchodilator. His previous HRCT report suggested fibro – bronchiectatic changes in anterior and medial basal segment of right lower lobe. He was managed with intravenous broad – spectrum antibiotics, nebulized bronchodilators and other supportive medications and referred for chest physical therapy.

On evaluation, we found his dyspnoea score to be grade 4 on Medical Research Council (MRC) scale. The MRC Dyspnoea Scale is a simple, standardized, self- administered scale to quantify the effect of breathlessness on daily activities and therefore, measures perceived respiratory disability. [7] Chest auscultation findings revealed bilateral coarse crepitations with decreased breath sounds. The quantity of sputum was measured to be 30 ml/ day. Leicester Cough Questionnaire was used to assess the cough characteristics. This Questionnaire is a valid, repeatable 19 – item quality of life measure of chronic cough. Several studies have been done to assess its reliability and validity in bronchiectasis. [8,9] The total score on Leicester Cough Questionnaire was 15.29. Conventional chest physical therapy in the form of postural drainage, breathing exercises and limb mobilization was started. However, patient found difficulty in expectorating and there was no improvement seen in his dyspnoea status even after a week of therapy. His oxygen saturation continued to fluctuate between 80% to 90%. Previous studies found good

diagnostic as well as therapeutic value of Lung Flute device in respiratory patients. ^[10-12] Hence, it was decided to give the patient a trial of Lung Flute[®] (Medical Acoustics, Buffalo, NY, USA) – a hand held oscillatory positive pressure device.

INTERVENTION

The patient was encouraged to use Lung Flute device in an upright sitting position. The regimen given was as follows:

1. Slow inspiration, slightly greater than normal outside the device
2. 2 prolonged exhalations into the device through the mouthpiece
3. This was followed by 5 relaxed normal breaths.

This completed one cycle. 20 such cycles were given in one session which lasted for 5 to 10 minutes. Patient performed 3 huff – coughs to expectorate secretions after performing all cycles. Patient was intervened twice daily with the Lung Flute. ^[13] Patient could repeat only 5 cycles for the first couple of days after which, the number of repetitions gradually increased to 20. Chest and limb physical therapy was continued as mentioned before. The patient was also given nebulized mucolytics and the antibiotic therapy was continued.

Since the technique of using Lung Flute was easy to understand, the patient followed the Lung Flute regimen diligently and found it easier to expectorate secretions. He also found the device very comfortable to use.

OUTCOME ASSESSMENT

The following outcome measures were assessed in the patient :

1. Sputum volume and colour - every 24 hours
2. Chest auscultation - before and after every treatment session

3. Oxygen saturation and the vital parameters - before and after every treatment session
4. Leicester Cough Questionnaire score – on the first and last day of treatment
5. Dyspnoea score on MRC scale - on the first and last day of treatment

Patient could effectively clear the secretions after the use of Lung Flute. The sputum volume reduced to 15 ml within 4 days and became negligible within 10 days of treatment. The colour of the sputum also changed from yellowish to white within 10 days. There was a gradual reduction of the crepitations with an improvement in breath sounds after every treatment session. The vital parameters remained stable during every treatment session and the oxygen saturation increased above 90% since the patient was able to successfully expectorate secretions. The patient showed a symptomatic relief in the chronic cough which was reflected in an improvement in the Leicester Cough Questionnaire score from 15.29 to 20.62 with an increase in the score in all the 3 domains (physical, social and psychological) at the end of 10 days of treatment session. Dyspnoea score also showed an improvement from grade 4 to grade 2 at the end of all treatment sessions. The patient remained stable and free from secretions and hence, could be successfully discharged from the hospital.

DISCUSSION

Cystic bronchiectasis severely impairs clearance of secretions from the bronchial tree. Chest physiotherapy plays an integral part of treatment in cystic bronchiectasis. ^[14] It is considered as a ‘Gold Standard’ for the mobilization and clearance of airway secretions in pulmonary conditions. ^[15] The conventional chest physiotherapy consists of postural drainage with manual chest techniques like

percussions and vibrations along with assisted coughing. Eaton T, Young P, et al (2007) in an RCT found that postural drainage was associated with more patient discomfort, was significantly more time-consuming and was felt to interfere more in the daily life than oscillatory PEP device. Patient preference for PEP device was also rated higher than postural drainage. ^[16]

Various assistive devices - both PEP and OPEP - have been designed as an adjunct to traditional airway clearance methods. ^[17] According to the past research studies, these devices are effective in improving pulmonary function, lung oxygenation, clearing mucus from bronchi and improving patient compliance in treatment. Also they decrease the respiratory complications, ^[15,18] are easy to use and reduce cost of therapy. ^[18] The theoretical benefit of PEP therapy is the ability to enhance and promote mucus clearance by either preventing airway collapse by stenting the airways ^[19] or increasing intrathoracic pressure distal to retained secretions, by collateral ventilation or by increasing functional residual capacity. ^[20] OPEP combines the purported benefits of PEP with airway vibrations or oscillations. Oscillations reportedly decrease the viscoelastic properties of mucus, which makes it easier to mobilize mucus up the airways, and create short bursts of increased expiratory airflow that assist in mobilizing secretions up the airways. ^[18] Secretion removal is then facilitated by the patient forcing deep exhalations through the device or with subsequent coughing and/or huffing techniques. By effectively clearing bronchial secretions, these devices improve pulmonary ventilation and gas exchange in various chronic respiratory conditions.

Lung Flute[®] (Medical Acoustics, Buffalo, NY, USA) is a novel OPEP device designed for enhancing secretion clearance using the low frequency acoustic wave

technology. It is a simple hand – held device consisting of a mouthpiece and a plastic reed within a rectangular chamber. When exhaled forcefully into the device, the reed oscillates and an acoustic wave of 16 to 25 Hz is generated with a sound output of 68 dBA using a minimal pressure of 1.0 cm H₂O. This sound wave has the ability to travel down the tracheobronchial tree and vibrate tracheobronchial secretions. This vibration enhances the mucociliary clearance of the lower respiratory tract, thereby, resulting in the induction of sputum. Sethi S, et al (2008) compared the effects of Lung Flute with Acapella in COPD with chronic bronchitis. The authors found that Lung Flute was a safe and effective OPEP treatment for mucus hypersecretion in COPD, and was equivalent to the Acapella for sputum clearance. Lung Flute was also shown to have a greater effect in improving quality of life in COPD than Acapella. J Rodriguez, et al (2011), in their comparative study between Lung Flute and Acapella on the vital signs and PEFr in normals, found that both the vital parameters and PEFr did not show any adverse change following the usage of Lung Flute, indicating it to be a safe device for use. ^[21] Lung Flute[®] received FDA approval by the United States in January 2010.

CONCLUSION

In conclusion, Lung Flute device is very effective in enhancing secretion clearance in cystic bronchiectasis. It is a simple, easy to use and cost-effective method thus, increasing patient compliance and independence in treatment. However, further research is needed to evaluate its long – term benefits and to underline its effect on the quality of life in chronic hypersecretory respiratory conditions.

REFERENCES

1. Tsang KW, Tipoe GL. Jun 2004. Bronchiectasis: not an orphan disease in the East. *Int J Tuberc Lung Dis.* 8(6): 691-702
2. Pande JN, Jain BP, Gupta RG, et al. 1971. Pulmonary Ventilation and Gas Exchange In Bronchiectasis. *Thorax.* 26: 727 – 733
3. Cole PJ. 1984. A new look at the pathogenesis, management of persistent bronchial sepsis: A 'viscious circle' hypothesis and its logical therapeutic connotations. In: Davies RJ. *Strategies for the Management of Chronic Bacterial Sepsis.* Oxford: Medicine Publishing Foundation; :1-20
4. Fiore JFF, Chiavegato LD, Paisani DM, et al. 2010. Utilization of positive pressure devices for breathing exercises in the hospital setting : a regional survey in Sao Paulo, Brazil. *Resp Care.* 55: 719 -724
5. Myers TR. October 2007. Positive Expiratory Pressure and Oscillatory Positive Expiratory Pressure Therapies. *Respir Care.* 52(10): 1308 – 1327
6. Hristara – Papadopoulou A, Tsanakas J, Diomou G, et al. Oct – Dec 2008. Current devices of respiratory physiotherapy. *Hippokratia.* 12(4): 211 – 220
7. Darbee Joan C, Ohtake Patricia J. March 2006. Outcome Measures in Cardiopulmonary Physical Therapy: Medical Research Council (MRC) Scale. *Cardiopulmonary Physical Therapy Journal.*
8. Birring SS, Prudon B, Carr AJ, et al. 2003. Development of a *symptom specific health status measure for patients with chronic cough : Leicester Cough Questionnaire (LCQ).* *Thorax.* 58: 339 – 343 doi :10.1136/thorax.58.4.339
9. Murray MP, Turnbull K, MacQuarrie S, et al. July 2009. Validation of the Leicester Cough Questionnaire in non-cystic fibrosis bronchiectasis. *European Resp Journal.* 34(1): 125 – 131 doi:10.1183/09031936.00160508
10. Rachael Ann Doreen D Nadal. July 2012. Lung Flute an effective bronchial hygiene therapy. *Philippine Council For Health Research And Development – R & D updates.*
11. Nigar Anjuman, Ning Li, Maria Guarnera, et al. 2013. Evaluation of lung flute in sputum samples for molecular analysis of lung cancer. *Clinical and Translational Medicine.* 2(15)
12. Fujita A, Murata K, Takamori M. Aug 2009. Novel method for sputum induction using the Lung Flute in patients with suspected pulmonary tuberculosis. *Respirology.*14(6): 899 – 902 doi: 10.1111/j.1440 – 1843.2009.01584.x.
13. Medical Acoustics. Product Overview. Lung Flute® operation. (Accessed 29 November 2008). Available from URL:[http://www.medicalacoustics.com/Home/Lung Flute/Overview/ LungFlute Operation](http://www.medicalacoustics.com/Home/Lung%20Flute/Overview/LungFlute%20Operation)
14. Murray MP, Pentland JL, Hill AT. Nov 2009. A randomized crossover trial of chest physiotherapy in non- cystic fibrosis bronchiectasis. *European Respir J.* 34(5): 1086 – 1092
15. Arens R, Gozal D, Omlin KJ, et al. 1994. Comparison of high frequency chest compression and conventional chest physiotherapy in hospitalized patients with cystic fibrosis. *Am J Respir Crit Care Med.* 150: 1154 - 1157
16. Eaton T, Young P, Zeng I, et al. 2007. A randomized evaluation of the acute efficacy, acceptability and tolerability of Flutter and active cycle of breathing with and without postural drainage in non –cystic fibrosis bronchiectasis. *Chron Respir Dis.*4: 23 – 30
17. Pryor JA. 1999. Physiotherapy for airway clearance in adults. *Eur Respir J.* 14(6): 1418 – 1424
18. McIlwaine M. 2006. Physiotherapy and airway clearance techniques and devices. *Paediatr Respir Rev.* 7(Suppl): S220 – S222

19. Oberwaldner B, Evans JC, Zach MS. 1986. Forced expirations against a variable resistance: a new chest physiotherapy method in cystic fibrosis. *Paediatr Pulmonol.* 2(6): 358 – 367
20. Groth S, Stafanger G, Dirksen H, et al. 1985. Positive expiratory pressure (PEP – mask) physiotherapy improves ventilation and reduces volume of trapped gas in cystic fibrosis. *Bull Eur Physiopathol Respir.* 21(4): 339 - 343
21. J Rodriguez, R Cardenas, V Flores, et al. May 2011. A comparison of Lung Flute and Acapella on the effect of vital signs and peak flows: a clinical trial. *J of Undergraduate Research In Respi Care.* 1(1): 4 - 11

How to cite this article: Ashwini D, Medha D. Effectiveness of lung flute - an OPEP device for bronchial hygiene in a patient with cystic bronchiectasis: a case report. *Int J Health Sci Res.* 2015; 5(5):570-575.

International Journal of Health Sciences & Research (IJHSR)

Publish your work in this journal

The International Journal of Health Sciences & Research is a multidisciplinary indexed open access double-blind peer-reviewed international journal that publishes original research articles from all areas of health sciences and allied branches. This monthly journal is characterised by rapid publication of reviews, original research and case reports across all the fields of health sciences. The details of journal are available on its official website (www.ijhsr.org).

Submit your manuscript by email: editor.ijhsr@gmail.com OR editor.ijhsr@yahoo.com