

Effectiveness of Threshold Inspiratory Muscle Training on Cystic Bronchiectasis - A Case Report

Dr. Karuna Kamble¹, Dr. Maria Lamuvel²

¹MPT in Cardio-Respiratory Physiotherapy, Dr. A. P. J. Abdul Kalam College of Physiotherapy

²Assistant Professor, Dr. A. P. J. Abdul Kalam College of Physiotherapy

Contact information: karunakamble88@gmail.com

Abstract: Bronchiectasis is characterized by an abnormal irreversible dilatation of the bronchi. It can be categorized according to radiographic and pathologic findings of airway obstruction and damage. A 48 year old male farmer by occupation was admitted to Intensive Care Unit of Pravara Rural Hospital 5 months back. The patient presented in the hospital with chief complaints of cough with expectoration associated with breathlessness and fever since 6 months. As per the investigations done in the hospital, the patient was diagnosed with cystic bronchiectasis. Outcome Measures PI_{max} was assessed by Hand Held Pressure Manometer. Threshold Inspiratory Muscle Training was given as an intervention to the patient for mucus clearance. The intervention was given 5 days in a week for a period of 2 weeks. After 2 weeks of intervention, there was significant improvement in Maximal inspiratory pressure. This case report established the evidence for the use of Threshold Inspiratory Muscle Training.

1. INTRODUCTION

Bronchiectasis is characterized by an abnormal irreversible dilatation of the bronchi. Patients with bronchiectasis have impaired mucociliary clearance and accumulation of secretions, predispose them to a vicious circle of bacterial infection and inflammation and the excessive inflammation cause damage or weakness of the bronchial wall and impairment of the effectiveness of cough.¹ Symptoms includes cough, sputum production, wheeze, dyspnoea, and decreased exercise tolerance.²

Inspiratory muscle weakness may lead to muscle load and capacity discordance and thereby; dyspnea, decreased exercise tolerance, hypoventilation and respiratory failure. A decrease in expiratory muscle strength impairs the effectiveness of coughing and decreases the removal of airway secretions.³ A hand held threshold device used for inspiratory muscle training contains a one-way spring-loaded valve with low to high intensities. Subjects can generate flow through the device to achieve a predetermined pressure independent of inspiratory flow rate and obtain constant specific resistance. It can enhance the velocity of inspiratory muscle contraction, shorten inspiratory time and allow more time for exhalation and lung emptying.¹ The rationale of applying inspiratory muscle training to bronchiectasis patients is that inspiratory muscle training can increase the strength and/or endurance of the respiratory muscles as the force generated by inspiratory threshold loading training can increase the cross-sectional surface areas of inspiratory muscles by hypertrophy, which will then have an effect on exercise capacity, quality of life, and perception of dyspnoea.⁴

Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP) are measures of maximal strength of respiratory muscles. Maximal Inspiratory Pressure (MIP) is the most widely used measure of respiratory muscle strength. It is determined by measuring upper airway pressure (mouth for patients) during a maximal voluntary inspiratory effort. The measured pressure is a composite of the pressure generated by the inspiratory muscles and the elastic recoil pressure of the lungs and chest wall.⁵ Black and Hyatt introduce a simple way to measure maximal respiratory pressure with a hand-held mouth pressure meter in cm H₂O. This is a way to quantitatively measure the function and respiratory muscle strength; this is indicative of the strength of inspiratory and expiratory muscle groups.⁶

Inspiratory muscle training (IMT) is currently used in pulmonary rehabilitation to increase the strength and endurance of the inspiratory muscles.⁷ The effectiveness of these devices has been proved, which stated that the PR-IMT devices work on improving the maximal inspiratory pressure (MIP).⁸ Usually, the patient begins training at a low load, equal to about one third of the Pimax and progresses slowly in small increments adjusting a screw to alter the tension until the training load reaches 60% of the current Pimax.⁷ This case study describes the effectiveness of the Threshold Inspiratory Muscle Training that plays an important role in improving inspiratory muscle strength of the patient.



Figure 1.1 Threshold IMT Device

2. CASE DESCRIPTION

A 48 year old male farmer by occupation was admitted to Intensive Care Unit (ICU) of Pravara Rural Hospital 5 months back. The patient presented in the hospital with chief complaints of cough with expectoration associated with breathlessness and fever since 6 months. As per the investigations done in the hospital, the patient was diagnosed with cystic bronchiectasis.

3. INVESTIGATIONS

A Chest Radiograph of the patient showed multiple cystic structures seen in bilateral lobes of the lungs which are a classical sign of cystic fibrosis. Bilateral honey comb appearance and tree bud appearance on both lung fields.

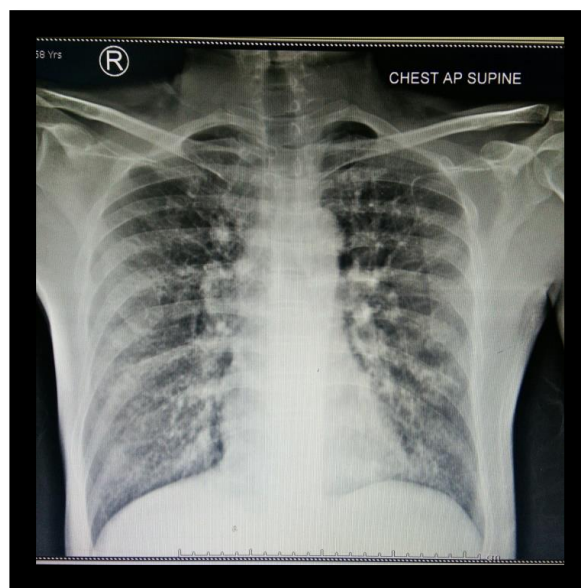


Figure 1.2 Chest Radiograph of the patient

OUTCOME MEASURES:

Hand Held Pressure Manometer PI_{max} (Maximal Inspiratory Pressure)

4. INTERVENTION

Before starting the intervention, a brief procedure about the treatment and its benefit was explained to the patient. A short explanation about possible improvements and adverse effects of the treatment simultaneously explained. Informed written consent was also obtained from the patient. The study was carried out in the ICU as per the patient admission and condition. Outcome Measures i.e PI_{max} was assessed by Hand Held Pressure Manometer on Day 1 and Day 14. The patient was taught how to perform the Threshold Inspiratory Muscle Training.

5. PROCEDURE

While performing the Threshold Inspiratory Muscle Training, the patient was in a relaxed sitting position. The patient was asked to seal lips around mouthpiece and inhale deeply, continue inhale and exhale without removing the device from mouth. Usually, the patient begins training at a low load, equal to about one third of the P_{max} and progresses slowly in small increments adjusting a screw to alter the tension until the training load reaches 60% of the current P_{max} . The intervention was given twice a day 5 days in a week for a period of 2 weeks.

6. DATA ANALYSIS AND RESULTS

After 2 weeks of intervention, there was a significant improvement in the P_{max}

Table 1: Represents the P_{max} values

	PRE	POST
P_{max}	70	85

7. DISCUSSION

The following case report was carried to evaluate the effectiveness of the Threshold Inspiratory Muscle Training in improving inspiratory muscle strength in bronchiectasis patient. Inspiration against resistance during IMT may increase the activation of the expiratory muscles by the last force extension, which may result in a significant increase in MEP.

Harver et al. observed that an eight-week, outpatient, high intensity, targeted inspiratory muscle training increased inspiratory muscle strength in the training group, but not in terms of lung function (FEV1 and FVC) and expiratory muscle strength in patients with chronic obstructive pulmonary disease.⁹ Enright et al. found that an eight-week inspiratory muscle training for adult cystic fibrosis patients increased the MIP of groups with 80% or 20% intensity training as compared to the control group, with no differences between the two training groups whereas; FEV1 and FVC were unaffected.¹⁰

8. CONCLUSION

In the present case report, IMT Threshold device was found effective in increasing the respiratory muscle strength. This device is widely been used for the cardiac condition and rarely been used for the other conditions therefore, IMT threshold device should be included in pulmonary rehabilitation which indirectly help in improving the Quality of Life and exercise capacity.

SUGGESTION FOR FUTURE RESEARCH: Further studies can be carried out in large sample size.

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