



## Physiotherapy for Respiratory Conditions

**Lalit Gupta<sup>1\*</sup> and Himani Gupta<sup>2</sup>**

<sup>1</sup>Department of Anesthesia, Maulana Azad Medical College, India

<sup>2</sup>Department of Musculoskeletal, Adhunik Institute of Education and Research, India

**\*Corresponding author:** Dr. Lalit Gupta, Department of Anesthesia, Maulana Azad Medical College & Associated Hospitals New Delhi, India, Tel no: 09868092739, 8588862786; Email: lalit.doc@gmail.com

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### Abstract

Physiotherapists are important clinical team members in intensive care units, respiratory wards, outpatient clinics and palliative care services [1]. In recent years, the evidence base for the use of physiotherapy in the form of appropriate exercises has grown in many areas, ranging from intensive care to chronic respiratory conditions [2,3]. Respiratory physiotherapy is not a new concept. Deep breathing exercises have been practiced for over a century to strengthen the chest, lungs, and stomach. Respiratory physiotherapy is primarily concerned with maintaining and restoring an individual's maximum respiratory functional ability [4]. It involves examination/assessment, planning and execution of treatment in form of respiratory exercises with step by step intervention and re-assessment.

**Keywords:** Physiotherapy; Respiratory Conditions; Breathing

**Abbreviations:** IPPV: Intermittent Positive-Pressure Ventilation; CPAP: Continuous Positive Airway Pressure; COPD: Chronic Obstructive Pulmonary Disease.

### Introduction

Respiratory conditions are most common cause of prolonged stay in hospital settings, with a vast variety of clinical diagnosis being assessed and need physiotherapy contribution along with medical treatment. Conditions which necessitate a must physiotherapy involvement include pneumonia, chronic bronchitis, asthma, bronchiectasis, cystic fibrosis, hyperventilation and chronic obstructive pulmonary disease [5]. The physiotherapist's role in patient care includes assessment, advice, education and active hands-on intervention. Traditionally, respiratory physiotherapists aid the mobilization and removal of secretions [6]. However, their scope extends to an array of measures for further betterment of patients like:

- i. Mobilizing secretions leading to effective coughing and removal of secretions.
- ii. To teach appropriate breathing patterns and control.
- iii. To mobilize thorax and shoulder girdle with proper postural awareness.
- iv. Reduce breathlessness and the work of breathing
- v. Improve the efficiency of ventilation
- vi. Support weaning from ventilators and support further noninvasive mechanical ventilation
- vii. Improve functional abilities and exercise tolerance (*i.e.* carrying out daily tasks)
- viii. Home management advice.

A physiotherapist should achieve the above aims with the goal of evidence-based practice in mind, *i.e.* [7] they should know the most effective intervention, based on the evidence, and integrate this knowledge and its application with clinical judgment and patient preference.

## Methods of Treatment

Physiotherapists often use mechanical devices, such as intermittent positive-pressure (IPPV) and CPAP equipment; tools that have been used in the profession since the mid-20th century. With the resurgence of interest in physiotherapy and knowledge of lung segments physiotherapists have a greater armory to deliver. Many individuals with life-threatening respiratory failure can be successfully managed in this way, avoiding intubation. Similarly, carefully selected devices can assist in mucus clearance and improvement in respiratory parameters. Exercise equipments have long been used in pulmonary rehabilitation programmes in different forms; however, physiotherapists may also use supplementary oxygen, noninvasive mechanical ventilation, complex training modalities or neuromuscular electrical stimulation to enhance the effectiveness of exercise training in respiratory patients [8].

Some of the commonly used exercises and principles employed in day to day chest physiotherapy are summarized as:

### For mobilizing secretions

**Breathing exercises:** Breathing exercises play an important role in overall pulmonary rehabilitation

programme of acute and chronic pulmonary disorders. They are basically designed

- a. To retrain respiratory Muscles
- b. To improve ventilation
- c. To decrease work of breathing

### Types of breathing exercises

- a. Diaphragmatic breathing
- b. Respiratory muscle training
- c. Segmental breathing or local basal expansion exercises
  - i. Apical expansion exercises
  - ii. Upper lateral costal expansion exercises
  - iii. Lower lateral costal expansion exercises
  - iv. Posterior basal expansion exercises
- d. Gloss pharyngeal breathing
- e. Purse lip breathing

**Postural drainage:** It consists of positioning with the gravity assistance for draining of a specific area /segment of the involved lung (Figure 1). Positioning is done in such a way to assist the required bronchus perpendicular to the ground for mobilizing secretions from involved segment to central airways, which are then suctioned out or removed by active coughing (Figure 2). Postural drainage technique involved the basic techniques of percussion, vibration and shaking [9].

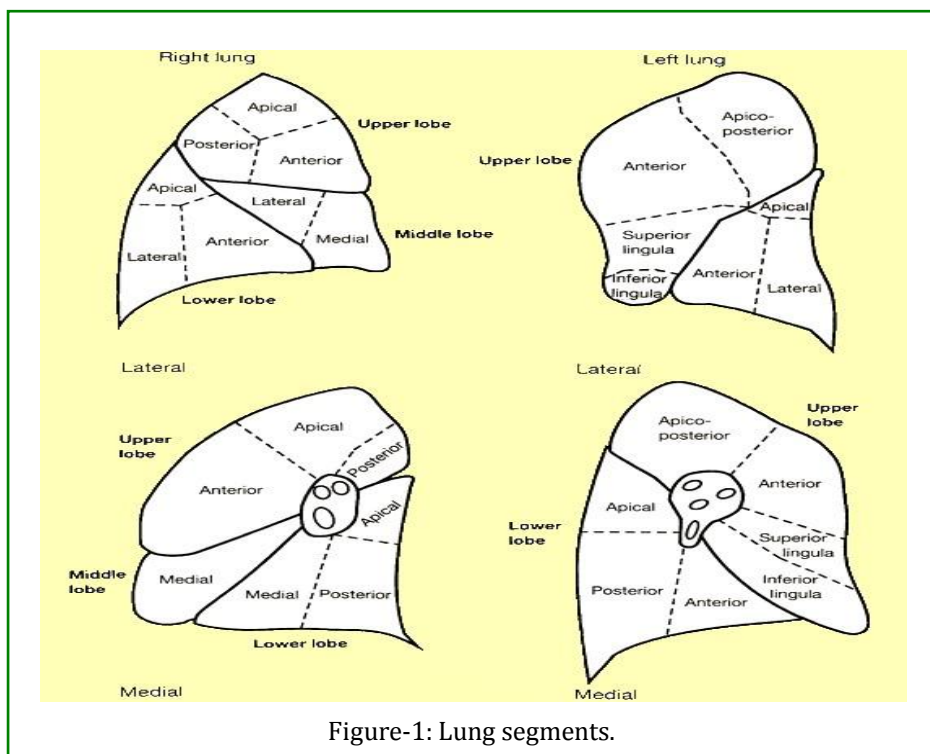
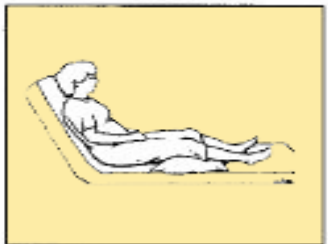
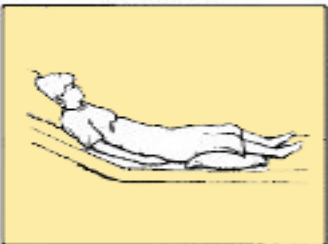

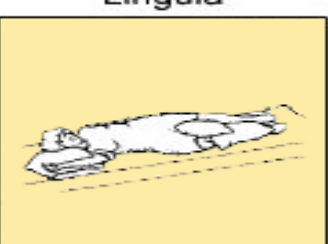
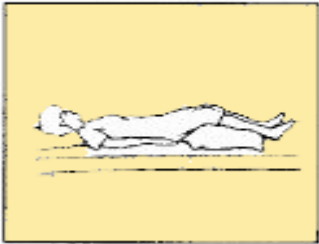
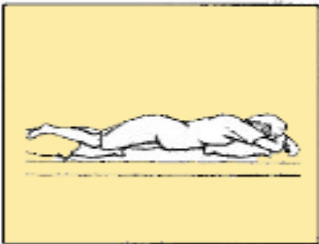
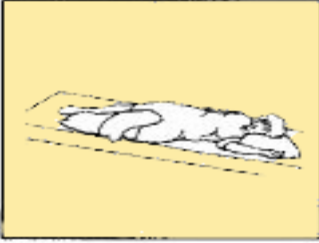

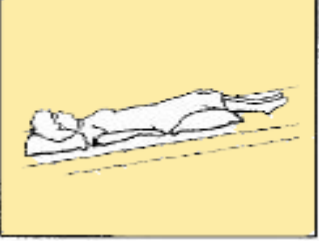


Figure-1: Lung segments.

**Positions:** Many respiratory diseases are characterized by the continuous production of sputum/mucus in the lungs. In cases like these, postural drainage is a very

common technique. This is where the physiotherapist will teach a patient to lie at certain angles or get into certain positions in order to help drain the lungs of fluid.

Lung segment	Position recommended	Representation
Both upper lobes Apical	High Fowler's position (semi-upright sitting position (45-60 ° and may have knees either bent or straight	<p>Both Upper Lobes Apical</p> 
Left upper lobe-anterior segment	Sitting on edge of the bed	<p>Left Upper Lobe Anterior</p> 
Left upper lobe-posterior segment	Side-lying with elevation of left side of the chest with pillows/support	<p>Left Upper Lobe Posterior</p> 
Lingula	One fourth turn on right side from supine, with pillows behind the back in 20°-30° head down position	<p>Left Upper Lobe Lingula</p> 

Right upper lobe-anterior segment	Supine with head end of the bed raised	<p>Right Upper Lobe Anterior</p> 
Right upper lobe-posterior segment	Side-lying with pillows under the right side of the chest for elevation	<p>Right Upper Lobe Posterior</p> 
Right Middle lobe	One fourth turn on left side from supine, with pillows behind the back in 20°-30° head down position	<p>Right Middle Lobe</p> 
Both lower lobes-superior segment	Prone lying	<p>Both Lower Lobes Superior</p> 
Both lower lobes-anterior segments	Laid flat on the back (supine position) with foot end of the bed raised	<p>Both Lower Lobes Anterior</p> 

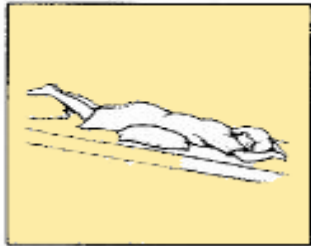
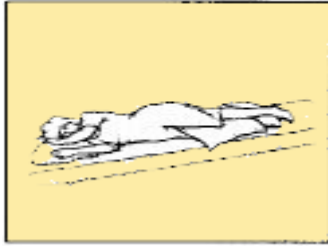
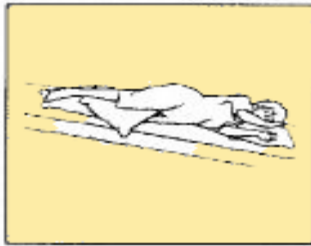
Both lower lobes -posterior segment	Prone with foot end of the bed raised	<p>Both Lower Lobes Posterior</p> 
Left lower lobe lateral position	Right side-lying with foot end of the bed raised	<p>Left Lower Lobe Lateral Segment</p> 
Right lower lobe lateral position	Left side-lying with foot end of the bed raised	<p>Right Lower Lobe Lateral Segment</p> 

Figure-2: Postural drainage positioning.

Body position has also been shown to affect oxygenation. Alterations in ventilation-perfusion inequality have been suggested as the main reason for improved oxygenation in these body positions.

#### Basic requirements

- Pillows
- Tilt table
- Sputum cup
- Paper tissues
- Vibrators / massagers approved for physiotherapy

#### Steps

- Nebulize the patient with saline / bronchodilator / mucolytic agents before starting any physiotherapy exercise to reduce bronchospasm, decrease viscosity of mucus and sputum, and thereby liquefying them for enhancing secretion removal [10].
- Make suitable position as per the force of gravity to drain out bronchial secretions from affected lung segments to the dependent central airways.
- The required positions are determined depending on the location, severity, and duration of mucous obstruction.
- The physiotherapy exercises are performed atleast twice or thrice a day before meals and bedtime and each position is done for 5-15 minutes.
- If patients develops signs of hypoxemia (tachycardia, palpitations, dyspnea, or chestpain) the procedure should be discontinued if occurs. Immediate discontinue the exercise if hemoptysis occurs.
- Comfort of the patient must be of paramount consideration for active participation for positional physiotherapy exercises.
- Must ensure to auscultate the chest before and after the positional exercises to ascertain effectiveness of exercises and to further determine the areas of needed drainage.

- viii. Encourage deep breathing and coughing after spending the adequate time in each position.
- ix. Diaphragmatic breathing should be encouraged throughout the postural drainage (this helps in widening of airways for effective secretions drainage).

### Massage manipulations

Manual or mechanical percussion and vibration are based on the assumption of transmission of oscillatory forces to the bronchi. This helps in mucus transport in addition to postural drainage and coughing.

**Vibration:** It has mechanical effect in moving secretions towards the main bronchi and also stimulates cough reflex.

- a. It should ideally be performed during expiratory phase.
- b. Vibration is applied either by placing both hands directly on the ribcage and over the chest wall or cupping with some facemask like device/single hand and gently compressing and rapidly vibrating the chest wall as patient exhales.
- c. After every three or four vibrations, patient should be motivated for deep coughing using diaphragm and abdominal muscles.
- d. Patient must be adequately rested in phases.
- e. After each cycle of vibration, chest should be auscultated with stethoscope for any new change/improvement in breath sounds.
- f. Each cycle of vibration should be decided according to the patient's tolerance and clinical response: usually 10-15 minutes.
- g. Vibration is to be avoided over the patient's breasts, spine, sternum, and rib cage to prevent any discomfort to the patient.
- h. Involvement of family members can also be considered both for motivation as well as for procedural performance after adequate training to them with mechanical devices.

**Shaking:** It also transmits mechanical energy like vibrations to loosen secretions. In supine the hands are placed on the anterior aspect of chest or one hand anteriorly or posteriorly. In side laying the hands may be placed together on the lateral aspect of the thorax anteriorly or posteriorly.

### Removal of secretions

Forced maneuvers like coughing and huffing, are considered as the main cornerstone of airway clearance techniques, and, thus, an essential part of every combination of treatment modalities. The concept is to enhance mucus transport due to forced maneuvers and

energy transfer between the high airflow velocity and the mucus layer thus dislodging the mucus and leading to its removal.

**Coughing:** It involves a deep breath (full lung volume), with the help of abdominal muscles to ensure that the expiration is sufficient to remove secretions from airways.

**Huffing:** It is a forced expiration against open glottis. It generates less intrathoracic pressure than coughing. The patient is instructed to take a medium size breath in (mid lung volume), involving the abdominal muscles with fast expiration making a strong sighing sound. It is performed with pursed lips with mouth slightly open.

**Forced Expiratory Technique:** It involves taking one or two huffs from mid to low lung volumes, with open glottis. Prerequisite for this involves a period of relaxed controlled diaphragmatic breathing before and after the procedure, with deep slow breaths [11].

### Relaxation

Relief of dyspnoea is often experienced by patients in different body positions. These specific positions will assist relaxation of the upper half of the thorax while encouraging controlled diaphragmatic breathing during the attack of dyspnoea [12]. Forward leaning has been shown to be very effective in COPD and is probably the most adopted body position by patients with lung disease. These relaxing positions involve:

- i. High side lying
- ii. Relaxed sitting
- iii. Forward kneel sitting
- iv. Relaxed standing
- v. Forward kneel standing

### Breathing Control

Patients having chronic respiratory disease usually have very high work of breathing and expend too much of respiratory efforts in this which should ideally be effortless. Such patients should be treated in relaxed position and taught breathing to establish a controlled pattern -counting 'one out -one in'. This is established at patient's own rate which would slow down once control has been gained (Slow and Deep Breathing) [13]. This causes a significant drop in respiratory frequency, and a significant rise in tidal volume and arterial oxygen tension at rest in patients with COPD [14,15]. Recruitment of the basal areas of the lungs is usually done by exercises involving 'tummy out with breathing in, tummy in with breathing out (Diaphragmatic Breathing).



Progression is made by altering the phasing to 'one, two out-one in' then 'one, two out-one in' then 'one,two,three out,-one two in'. The patient's position is then altered to reduce support until he or she is able to stand, walk and go up or down stairs with breathing control. Such patients are taught to breathe out when bending down and to breathe in when straightening up during everyday activity (e.g. taking water bottles from refrigerator, mopping the floor, etc).

### Postural awareness

Rounded shoulders, kyphosis, lordosis, scoliosis and head thrust forward are common postural abnormalities. Such abnormalities limit thoracic spine mobility and hence decrease chest expansion. Therefore it is essential to teach patients to relax the upper torso, straighten the spine and keep the head erect while walking or sitting. This must be applied in positions of work and when sitting resting, e.g. reading or watching television.

### Mobilizing the thorax and shoulder girdle

Exercises involving thorax and shoulder are useful in mobilizing the lower part of the thorax and to encourage basal expansion to prevent atelectasis and improve coughing.

Examples of such exercises are:

- a. Sitting; trunk turning or bending with arms relaxed.
- b. Under bend sitting (first on side of chest wall), trunk bending sideways.
- c. Sitting; shoulder girdle circling backwards.
- d. Sitting; trunk bending forwards with breathing out and trunk raising with breathing in.
- e. Sitting; arms raising forwards and upwards, and lowering sideways.
- f. Sitting trunk bending forwards and to the left and stretching upwards backwards and to the right- repeat to the other side.

### Home Management

The physiotherapist must discuss with each patient suffering chronic respiratory disease how treatment is carried out at home. This will include formal teaching to the patient and family members' involved about the feasibility of postural drainage positions by performing some commonly used day to day activities. Breathing exercises with webbing belt helps the patient to practice basal expansion. Methods of safe disposing of sputum should be discussed. Self percussion and vibration maneuver by commercially available vibrators and massagers along with timely nebulization and steam with regular exercises have to be fitted in to the patient's lifestyle.

### Conclusion

Physiotherapy is cornerstone for non-medical treatment of patients with respiratory disease. In addition to its traditional role in the treatment of airflow obstruction and mucus retention, other aspects of respiratory disorders such as in ventilatory dysfunction, dyspnoea and quality of life are also benefitted by physiotherapy interventions. Respiratory physiotherapy aims to improve ventilation in respiratory diseases with a variety of techniques by improving inspiratory muscle strength and that also aid in clearance of sputum by bronchopulmonary techniques. It involves a variety of strategies aimed at reducing the work of breathing, improving ventilation, increasing function, and enabling relief of dyspnoea. Exercise training, peripheral and respiratory muscle training, airway clearance techniques, and breathing retraining have been shown to be effective treatments in a variety of conditions affecting the respiratory system, if properly employed.

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