



PULMOPHYSIOTHERAPY / CHEST PHYSIOTHERAPY

OVERALL GOAL: To improve the cardiorespiratory function of the patients

Specific goals of Pulmophysiotherapy are as follows:

1. Prevent airway obstruction and accumulation of secretions
2. Improve airway clearance and ventilation.
3. Improve endurance & general exercise tolerance.
4. Reduce energy costs during respiration.
5. Prevent or correct postural deformities and other complications associated with respiratory disorders
6. Promote relaxation
7. Maintain or improve chest mobility
8. Improve cough effectiveness

COMPONENTS OF PULMOPHYSIOTHERAPY PROGRAM

1. Positioning
2. Manual Techniques
 - A. Percussion
 - B. Vibration
 - C. Shaking
3. Cough
4. Suctioning
5. Breathing Exercises
6. Chest Mobilization Exercise
7. Dyspnea Relieving Positions
8. Work simplification & Energy conservation techniques

I. BREATHING EXERCISES

- ◆ designed to retrain the muscles of respiration and improve or redistribute ventilation, lessen the work of breathing, and improve gas exchange and oxygenation.

A. INDICATIONS

1. Acute or chronic lung disease (Restrictive or Obstructive)
2. Thoracic & abdominal pain due to trauma or surgery



This is only a supplementary hand-out, it cannot be used as a reference.

3. Airway obstruction due to bronchospasm or secretions
4. SCI and other neuropathic conditions causing weakness of the chest muscles
5. Severe orthopedic abnormalities especially deformities of the spine
6. Stress management

B. GOALS OF BREATHING EXERCISE

1. Improve ventilation
2. Improve effectiveness of cough mechanism
3. Prevent atelectasis
4. Improve strength, endurance & coordination of respiratory muscles; improve efficiency and lessen work of respiration
5. Maintain or improve chest and thoracic spine mobility
6. Correct inefficient or abnormal breathing pattern
7. Promote relaxation
8. Teach the patient how to deal with shortness of breath attacks
9. Retrain muscles of respiration

C. GUIDELINES AND PRECAUTIONS

Guidelines for Teaching Breathing Exercises

1. Choose a quiet place.
2. Explain the rationale and goals of the exercise/training.
3. Have the pt. assume a comfortable and relaxed position and loosen restrictive clothing. Initially start in a semi-Fowler's position (head and trunk supported at 45 degrees with hip and knee flexed and pillow under the legs).
4. Observe and assess the pt's spontaneous breathing pattern while at rest and after the activity.
5. Determine if ventilatory training is indicated.
6. Establish a baseline for assessing changes, progress, and outcomes of intervention.
7. If necessary, teach the patient relaxation techniques. Pay particular attention to the relaxation of the SCM, upper trapezius and levator scapulae.
8. Determine whether to emphasize inspiratory or expiratory phase of ventilation.
9. Demonstrate the desired breathing pattern to the pt.
10. Have the pt practice the correct breathing pattern in a variety of positions.
11. All breathing patterns should be deep, voluntarily, controlled and relaxed



Precautions!!!

1. Never allow pt to **force expiration**. It should be relaxed or lightly controlled. Because forced expiration increases turbulence in the airways leading to bronchospasm and increased airway restriction.
2. Do not allow pt to take a **highly prolonged expiration**. This causes pt to gasp with the next inspiration and the breathing becomes irregular and inefficient.
3. Do not allow pt to initiate inspiration with the accessory muscles and upper chest. Advise the pt the upper chest should be relatively quiet during breathing.
4. Allow the pt to perform deep breathing for only 3 to 4 reps to avoid hyperventilation.

TYPES OF BREATHING EXERCISE

1A. DIAPHRAGMATIC BREATHING

Rationale: to improve the efficiency of ventilation, decrease work of breathing, increase the excursion of the diaphragm and improve gas exchange and oxygenation

Indications:

- inefficient ventilation
- increase work of breathing
- decrease diaphragmatic excursion
- poor gas exchange and oxygenation
- postural drainage to mobilize lung secretions

Procedure:

1. Pt position: semi-Fowler. In this position, gravity will assist the diaphragm.
**Assessment:* pt initiates breathing pattern with the accessory muscles (shoulder and neck)
2. PT instruction: Relax those muscles by shoulder rolls or shrugs
3. PT places his hand/s on the rectus abdominis below anterior costal margin.
4. PT asks the pt to breathe in slowly and deeply through the nose while keeping the shoulders and upper chest quiet, allowing the abdomen to rise slightly.
5. PT asks then the pt to relax and exhale slowly through the mouth.
6. Practice for 3-4x then rest.
** if pt is having difficulty inhaling using the diaphragm:*
7. PT asks the pt to inhale by sniffing for several times.
8. Self-monitoring: Ask th pt to place his hand on th abdomen, the hand should rise slightly during inspiration and fall during expiration.
9. Practice DDBE in varying positions (sitting, standing, walking or climbing stairs)

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EBP: inconclusive results of its effects on the rate of ventilation, work of breathing and oxygen consumption, excursion of the diaphragm and exercise capacity in normal subjects

1B. SEGMENTAL BREATHING

Rationale: to emphasize expansion on problem areas of the lungs or chest wall

Indications:

- hypoventilation 2° to fibrosis, pain, muscle guarding p surgery, telecasts, pneumonia
- stiff lower rib 2° to chronic bronchitis, emphysema, asthma
- post surgical pt confined in a semireclining position

I. Lateral Costal Expansion/ Lateral Basal Expansion

- can be carried out *unilaterally or bilaterally*
- Indicated: stiff lower rib seen in chronic bronchitis, emphysema or asthma

Procedure:

1. Pt position: hook lying (progression: sitting)
2. PT places his hands along the lateral aspect of the lower ribs to direct pt's attention to the areas where movement is to occur.
3. PT asks the pt to breathe out and feel the rib cage move downward and inward while PT is applying pressure on the ribs at the same time.
4. Before inhalation, PT applies a **QS downward and inward** to facilitate the external intercostals.
5. PT applies light manual resistance to the lower ribs as the pt breathes in to increase sensory awareness.
6. Repeat the same procedure.
7. Teach pt to perform it independently or with use of a belt/towel in applying resistance.

II. Posterior Basal Expansion

- Indicated: post surgical pt confined to a semi reclining position in bed

Procedure:

1. Pt position: sitting while leaning forward on a pillow, slightly bending the hips
2. PT places hands over the posterior aspect of the lower ribs.
3. Repeat same procedure.



1C. PURSED LIP BREATHING

- it involves lightly pursing the lip during controlled exhalation
- keep airways open by creating a back pressure

Rationale:

- decreases respiratory rate and work of breathing
- increases the tidal volume
- improves exercise tolerance

Indications:

- COPD (to deal with dyspnea; it can decrease the perceived level of exertion during activity)

Procedure:

1. Pt position: anything as long as pt is comfortable and relax.
2. PT asks the pt to breathe in slowly and deeply through the nose and then breathe out gently through lightly pursed lips as if blowing on and bending the flame of a candle but not blowing it out.

Precaution:

1. Expiration must be relaxed and there should be no abdominal contraction. PT places his hand on the abdominals to check.

SUMMARY

TYPES	DESCRIPTION	INDICATION
DIAPHRAGMATIC BREATHING	<ul style="list-style-type: none"> - Involuntary - Designed to improve ventilation, oxygenation & excursion of diaphragm - Used to mobilize secretion - <i>Precautions: AVOID HYPERVENTILATION</i> 	<ul style="list-style-type: none"> - COPD - Pneumonia - Pre & Post postural drainage
PURSE-LIP BREATHING	<ul style="list-style-type: none"> - promotes longer expiration - keeps airway open by creating 	<ul style="list-style-type: none"> - COPD with SOB - Asthma

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TYPES	DESCRIPTION	INDICATION
	back pressure in the airway - Dec RR, Inc TV, & improve exercise tolerance - <i>Precautions: AVOID forceful expiration</i>	
GLOSSO-PHARYNGEAL BREATHING	- Inc Inspiratory capacity & vital capacity in presence of severe mm weakness - non- invasive method for supporting ventilation	- High SCI (Quadriplegic), - Post- Polio
SEGMENTAL BREATHING a. Lateral costal expansion b. Posterior basal expansion c. Right middle lobe or lingula expansion d. Apical expansion	- used to expand localized areas of the lungs while keeping the others quiet - important for bedbound post-surgical patient in semi-upright position	- Atelectasis - Pneumonia - Post- surgical cases

ADDITIONAL BREATHING TECHNIQUES

1. PREVENTING AND RELIEVING EPISODES OF DYSPNEA

Pt's with COPD may suffer from dyspnea with physical exertion or when in contact with allergens. Prevention of dyspnea can be done by controlled breathing techniques, pacing activities and becoming aware of the what activity precipitates attack. Teaching the pt about the signs of dyspnea may help to recognize attacks then pt will promptly stop the activity and use controlled, pursed lip breathing.



Pacing - performance of functional activities like walking, stair climbing or work-related tasks within pt's ventilatory capacity.

Procedure:

1. Pt position: relaxed, forward-bent posture (forward-bent position can stimulate diaphragmatic breathing as the viscera drops forwards making room for the diaphragm to descend more.
2. Use pursed-lip breathing during expiration to control his breathing.
3. Use diaphragmatic breathing during inhalation and minimize use of accessory muscles.
4. Repeat steps 2 and 3 until dyspnea subsided.

2. POSITIVE EXPIRATORY PRESSURE BREATHING or Positive Expiratory Pressure (PEP)

Therapy

- Gets air into the lungs and behind the mucus using extra (collateral) airways. PEP holds airways open, keeping them from closing. A PEP system includes a mask or mouthpiece attached to a resistor set by your CF care team. The person breathes in normally and breathes out a little harder against the resistance.

- breathing technique in which resistance coming from a specially designed mouthpiece or mask is applied during exhalation

- an alternative to postural drainage

Rationale:

- to mobilize accumulated secretions thus improve clearance (as it hold the airways open during exhalation)

Procedure:

1. Pt position: sitting comfortably with elbows resting on a table.
2. PT asks pt to inhale (tidal and active but not forced) and exhale through a mouthpiece or mask.
3. PT asks the pt to hold the inhalation for 2-3 seconds, then exhales, 10-15 cycles.
4. PT asks the pt to remove the mouthpiece or masks, take several "huffs" and then cough.

Rx: PEP breathing x 4-6 times x 15 minutes x OD

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3. RESPIRATORY RESISTANCE TRAINING (RRT)

- aka ventilatory muscle training, inspiratory (or expiratory) muscle training, inspiratory resistance training, flow-controlled endurance training

Rationale: to train the muscles of inspiration by

(1) improving ventilation in pt's with pulmonary dysfunction associated with weakness, atrophy or inefficient diaphragm

(2) improving the cough mechanism in pt's with weak abdominals or expiratory muscles

Outcome measures:

- thickness of the diaphragm
- maximal voluntary ventilation
- decreased use of accessory muscles
- increased cough effectiveness
- vital capacity, FEV1, inspiratory mouth pressure using a spirometer

Precautions!!!

Do not over fatigue the diaphragm because unlike extremity muscles, it cannot fully rest thus it does not fully recover. Sign of fatigue is use of accessory muscles.

- **VENTILATORY MUSCLE TRAINING**

- focus on training the muscles of inspiration

- **3 forms of VMT**

- A. Diaphragmatic training using weights

- application of weights (3-5 lb) over epigastric area

- B. Inspiratory resistance training

- patient inhales through a device made of narrow tubes of varying diameters.
- the narrower the tube the greater the resistance

- C. Incentive Respiratory Spirometry

- form of level resistance training
- used to prevent alveolar collapse in post-op patients & strengthen weak inspiratory muscles in neuromuscular disease patients



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PRECAUTIONS: Avoid prolonged resistance training of the diaphragm since the diaphragm will easily fatigue.

- PREVENTING & RELIEVING SHORTHNESS OF BREATH ATTACKS
 1. Controlled Breathing
 2. *Pacing* - performance of functional activities within the limits of a patient's breathing pattern capacity.
 3. Use Dyspnea-Relieving Positions

II. CHEST MOBILIZATION EXERCISE

- ◆ exercises that combine active movements of the trunk or extremities with deep breathing

A. GOALS

1. Maintain or improve mobility of the chest wall trunk & shoulders
2. Reinforce or emphasize the depth of inspiration or controlled inspiration

B. SPECIFIC EXERCISES

1. To mobilize one side of the chest
2. To mobilize the upper chest & stretch the pectoralis muscle
3. To mobilize the upper chest & shoulders
4. To increase expiration during deep breathing
5. Wand exercises

III. COUGHING EXERCISE

- ◆ Series of Actions that occur when Patient Coughs:
 1. Deep inspiration occurs
 2. Glottis closes and vocal cords tighten
 3. Abdominal muscles contract and diaphragm elevates
 4. Glottis open
 5. Explosive expiration occurs.
- ◆ Cough pump is effective up to the 7th generation of bronchi in normal individuals.
- ◆ HUFF VS COUGH

ADDITIONAL MEANS OF FACILITATING A COUGH

1. Manual assisted cough
 - for patient with abdominal weakness

Therapeutic Exercise 1

This is only a supplementary hand-out, it cannot be used as a reference.

- can be applied by either the therapist or the patient
- 2. Splinting
- 3. Humidification
- 4. Tracheal tickle
 - used with infants and uncooperative disoriented patients

PRECAUTION: In teaching an effective cough never allow the patient to suck air by gasping.

- Avoid forceful coughing in CVA & aneurysm

SUCTIONING - *alternative to coughing*

- *all patients with artificial airways*

IV. POSTURAL DRAINAGE

- Clearing the airways of secretions by placing the patient in various positions to attain gravity-assisted drainage of mucus

GOAL: To facilitate drainage secretions into segmental bronchus

INDICATIONS:

Prevent accumulation of secretions	Remove secretions
<ul style="list-style-type: none">• Chronic bronchitis• cystic fibrosis• Post-general anesthesia surgical px• post-op pain restricting chest expansion & coughing• Px on prolonged bed rest• Medically stable px on ventilator	<ul style="list-style-type: none">• Pneumonia• Atelectasis• acute lung infections• COPD• very weak or elderly• Px with artificial airways

CONTRAINDICATIONS

1. Severe hemoptysis
2. Severe pulmonary edema
3. Congestive heart failure
4. Pulmonary embolism
5. Pneumothorax
6. Cardiac arrhythmia
7. Severe hypertension



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8. Recent MI
9. Recent neurosurgery

POINTS TO CONSIDER

1. Not done directly after a meal
2. Preferably in the morning & early evening
3. If secretions are thick & copious, do 2-4 times/day
4. Maintenance- 1-2 times per day
5. Maintain position for 5-10 min, if tolerated, or until productive; if unproductive after 5-10 mins change position
6. Total duration of treatment should not exceed 40-45 min
7. whenever possible stand before patient so PT can observe his color
8. Patient should do relaxed deep breathing while draining
1. Encourage sharp, double cough; use vibration after several deep breaths to elicit a cough.

INDICATION TO DISCONTINUE POSTURAL DRAINAGE

1. X-ray is relatively clear
2. Patient on regular home program
3. Patient afebrile for 24-48 hours
4. Have normal or near normal breath sounds on auscultation

TECHNIQUES USED DURING POSTURAL DRAINAGE

a. Deep breathing

b. Deep coughing

c. Percussion – rhythmic & alternate striking of the chest wall over specific lung segments with cupped hands to dislodge retained secretions

Contraindications:

1. Over bony prominence
2. over breast tissue in females
3. over fractures, spinal fusion or osteoporotic bone
4. over tumor area
5. pulmonary embolus
6. unstable angina
7. presence of fluid pus, blood, cavitations in lungs
8. chest wall pain

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d. Vibration

e. Shaking

MODIFIED POSTURAL DRAINAGE

- ❖ Congestive heart failure patients with orthopnea
- ❖ Post-neurosurgery patients where head down position is CI
- ❖ Cardiothoracic post-surgical patients with chest tubes/monitoring wires

POSTURAL DRAINAGE POSITIONS

SEGMENT DRAINED	POSITION	SITE OF PERCUSSION
Anterior Apical	Sitting; leaning backward on chair	Under clavicle
Posterior Apical	Sitting; leaning forward on table	Above scapula
Anterior	Supine; pillows Under knees & thigh	Males- over nipple Female- above breast
(L) Posterior	¼ from prone resting on ® side; head/shoulder elevated 45°(Tilt table). 18”(pillow)	(L) scapula
® Posterior	Flat on bed; ¼ turn from prone; lie on left side	® scapula
Lingula	¼ from supine on ® side; 30° head down position	Under the (L) breast
Middle lobe	¼ from supine on left side 30° head down position	Under ® breast
Anterior basal	Supine; pillow below knees 45° head down position	Over lower portion of ribs bilaterally
Posterior basal	Prone; pillow below knees 45° head down position	Over lower portion of ribs bilaterally
(L) lateral	side lying on ®; 45° head down position	Lower lateral aspect of (L)rib cage
® Lateral	side lying on (L); 45° head down position	Lower lateral aspect of ® rib cage
Superior	Prone; pillow under abdomen	Directly below scapula

V. Active Cycle of Breathing Technique (ACBT)

- involves a set of breathing techniques. It can be changed to meet each person's needs. It gets air behind mucus, lowers airway spasm and clears mucus. It includes:

- Breathing control — normal, gentle breathing with the lower chest while relaxing the upper chest and shoulders.
- Thoracic expansion exercises — deep breaths in. Some use a three-second breath-hold to get more air behind the mucus. This may be done with chest clapping or vibrating, followed by breathing control.
- Forced expiration technique — huffs of varied lengths with breathing control.



VI. Autogenic Drainage (AD)

- means "self-drainage." It uses varied airflows to move mucus. It aims to reach very high airflows in different lung parts. This moves mucus from small to large airways. AD has three parts:

- Dislodging mucus
- Collecting mucus
- Clearing mucus

The person inhales to different levels and then adjusts how they breathe out to heighten airflow and move mucus. At first, AD takes hard work and practice. It is best for people over 8 years old.

Reference for I – IV:

Kisner, C. & Colby, L.A. (2007). Therapeutic Exercise Foundations and Techniques, 5th ed.

Reference for V – VII:

www.cfvoice.com/info/articles/airway_clearance.jsp

- <https://docs.google.com/open?id=0BwB7enu3pGzLYXZNeVBnNnA3RWs>
(ACBT Video)