

STRATEGIES TO IMPROVE LUNG VOLUME AND CAPACITIES

POSITIONING

Reduced lung volumes respond well to increasing patient mobility. This may consist of upper limb exercise in bed for the immobile patient, transferring patients to chairs, walking on the spot or climbing a flight of stairs. It is a simple yet effective treatment technique. For patients who are unable to sit out of bed, lower thoracic expansion exercises may be taught instead, in conjunction with good positioning.

Changing a patient's position can increase lung volumes by choosing one that will allow better excursion (movement) of the diaphragm. Lying supine or slumped in bed will decrease lung volumes by pushing the abdominal contents up against the diaphragm, limiting movement.

For patients with a unilateral problem, such as a chest infection, consolidation should lie with the affected lung uppermost, as optimal ventilation and perfusion will occur in the dependent (lower area) lung.

Upright position is considered as the physiologically the best position

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BREATHING EXERCISES

- ▶ Breathing exercises are exercises to train the muscle and improve or redistribute ventilation.
- ▶ Lessen the work of breathing and improve gas exchanging and oxygenation.

Goal of breathing exercises

- ▶ Improve ventilation
- ▶ Increase the effectiveness of cough mechanism
- ▶ Prevent pulmonary impairment
- ▶ Improve the strength
- ▶ Improve the thoracic spine mobility
- ▶ Promote relaxation
- ▶ Improve a patients overall functional capacity.
- ▶ Correct inefficient breathing pattern

Principle

- ▶ Choose quite and clean area
- ▶ Explain to the patient about aim
- ▶ Comfortable relaxed position
- ▶ Observe the nature of patient
- ▶ Relaxation technique
- ▶ Demonstrate the desire breathing pattern
- ▶ Have the patient practice the correct breathing pattern

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Precaution

- ▶ Never allow patient to force expiration.
- ▶ Do not allow the patient to take a very prolonged expiration.
- ▶ Do not allow the patient to initiate inspiration with accessory muscle.
- ▶ Allow the patient to practice deep breathing for only three or four at a time to avoid hyperventilation.

Diaphragmatic exercises

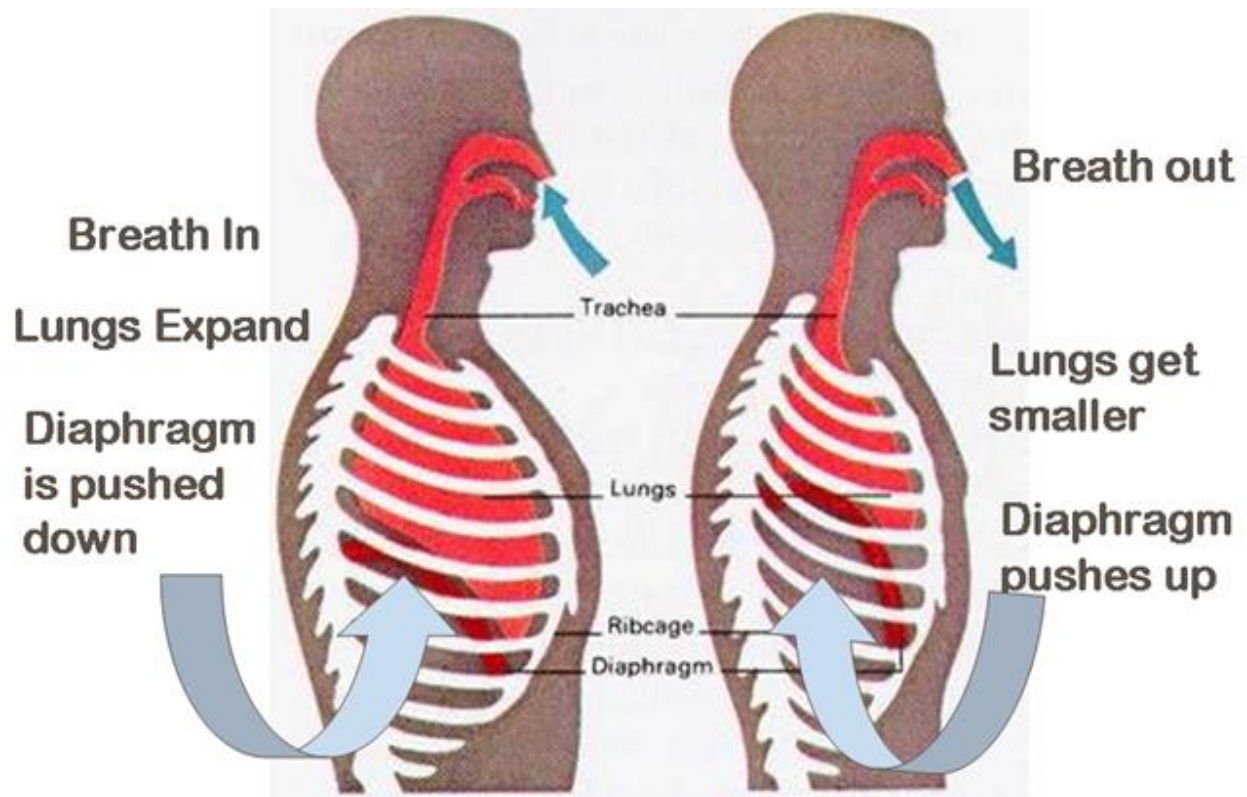
Diaphragm control breathing at involuntary level improve the efficiency of ventilation. Decrease the work of breathing.

- ▶ Increase the excursion and improve gas exchange.

Procedure

- ▶ Prepare patient in a relaxed position semi fowler
- ▶ Place your hand on rectus abdominals below the anterior costal margin.
- ▶ After the patient understands and is able to breathe using a diaphragmatic pattern ,suggest that breath in through the nose and out through the mouth.
- ▶ Controlled expiration 4 or 5 times
- ▶ Diaphragmatic breathing exercises are designed to improve the efficiency of ventilation and also used to mobilize lung secretions during postural drainage.

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Segmental exercises

- ▶ It is questionable whether a patient can be taught to expand localized area of lung while keeping other area quite
- ▶ Lateral costal expansion
- ▶ It is also called lateral basal expansion .may be unilaterally or bilaterally
- ▶ Posterior basal expansion
- ▶ Right middle lobe lingula expansion

Procedure

- ▶ Lateral expansion-patient may be sitting

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- ▶ Place your hand along the lateral aspect of lower rib to fix the patient attention to the area where movement is to occur
- ▶ Patient to breath out ,feel rib cage move downward and inward
- ▶ Tell the patient to expand the lower rib against your hand as he or she breathes in
- ▶ Apply gentle manual resistance to the lower rib area.

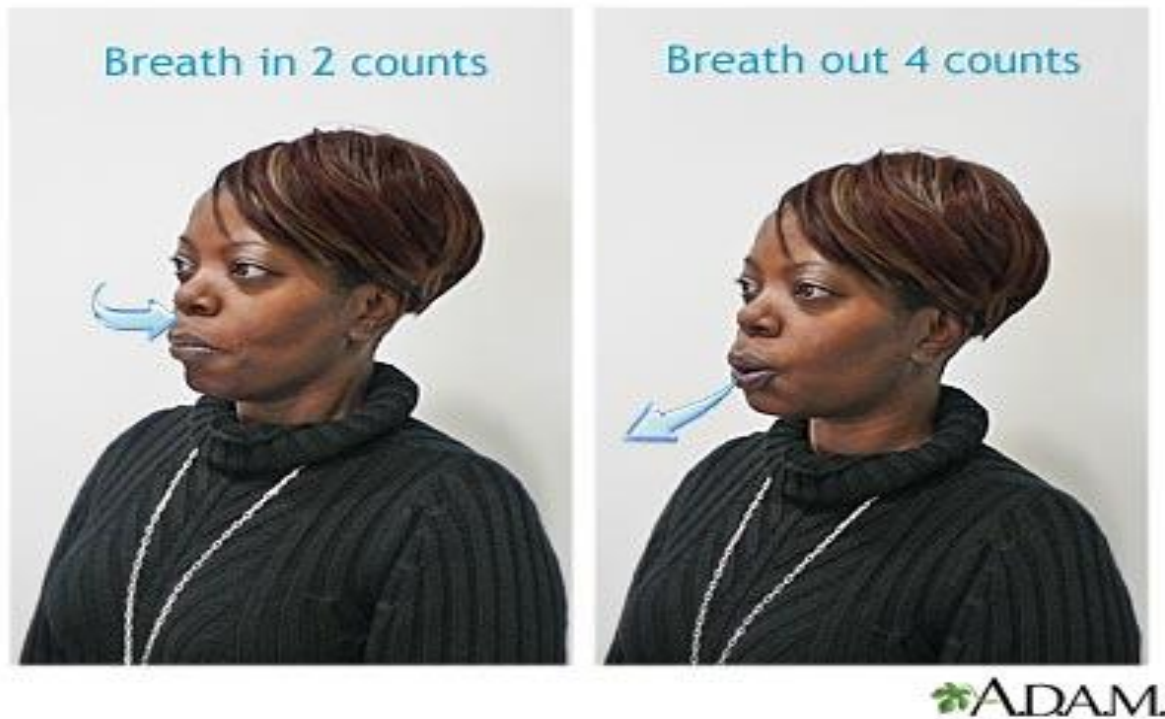
Pursed lip breathing

- ▶ In Some patient it is used ,COPD
- ▶ Pursed lip breathing decrease the respiratory rate, increase tidal volume and improve exercise tolerance.
- ▶ Keep airway open by creating a back pressure in the airway.
- ▶ Help a patient with chronic with chronic obstructive pulmonary disease
- ▶ Precaution-avoid the forced expiration
- ▶ Contraction of the abdominal muscle must be avoided

Procedure

- ▶ Have a patient assume a comfortable position and relax as much as possible
- ▶ Explain to the patient that expiration must be relaxed and that contraction of the abdominal must be avoided.
- ▶ Place your hand over the patients abdominal muscle to detect any contraction of abdominals
- ▶ Patient to breathe in slowly and deeply and then patient loosely purse the lips and exhale.

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Glossopharyngeal breathing

- ▶ This technique is known as frog breathing
- ▶ The muscle use in this technique do not have the same internal proprioceptive ,sensory or visual feedback mechanism as trunk and limb muscle
- ▶ Glossopharyngeal breathing is a means of increasing a patients inspiratory capacity when there is severe muscle weakness of inspiratory muscle
- ▶ Post polio patient with severe muscle weakness
- ▶ Patient takes on several gulps of air

Procedure

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- ▶ Mouth open to draw in air
- ▶ Then mouth is closed and tongue pushes the air back and traps in pharynx
- ▶ The air is then forced into lungs when glottis is opened
- ▶ This increase the depth of the inspiration and patient vital capacity
- ▶ Contradiction for this technique is tmj disorder

Ventilatory muscle training

- ▶ This technique usually focuses on training the muscle of inspiration
- ▶ **Vmt** has been used in treatment of patients with variety of acute or chronic pulmonary disorder associated with weakness ,atrophy of the muscle of inspiration

Procedure

- ▶ **Diaphragmatic training using weights**
- ▶ Have the patient assume a supine or slightly head-up position.
- ▶ Be sure that patient know how to using the diaphragm.
- ▶ Place a small weight 3 to 5lb over the epigastric region.
- ▶ Gradually increase the time that the patient breathes against the resistance of weight.
- ▶ Manual resistance or positioning can also be used to strengthen the diaphragm.
- ▶ Inspiratory resistance training-breathing devices are used for inspiratory resistance training to improve the strength and endurance of the muscles of inspiration.

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CHEST MOBILIZATION TECHNIQUES

Chest mobilization techniques are the original protocol used in chronic lung disease, which has the tendency to cause poor posture, rigidity, or lack of thoracic spine and rib cage movement. These techniques are divided into passive and active chest mobilization, which depends on the patient's condition. In the case of an unconscious patient, as seen in an intensive care unit (ICU) where prolonged treatment is carried out with or without ventilator support, the “**Passive Chest Mobilization Technique**“ can be performed on the chest wall by a therapist. Whereas, in the case of a patient in recovery or good condition, the “**Active Chest Mobilization Technique**“ can be performed. The aim of these techniques is to improve thoracic mobility at the upper, middle or lower parts of the chest. Furthermore, these techniques need to be selected carefully to minimize dyspnea, and they should be applied in sitting, sitting leaning forward or high side lying positions.

Antero-posterior upper costal chest wall mobilization

The original technique is similar to the previously mentioned protocol. This pattern is suitable for giving benefit in cases of shortening pectoralis muscles. Winging and trunk rotation can improve vital capacity. The benefits of this pattern improve both ventilation in upper lobes of boths and also stretches the pectoralis muscle that may tight.

Postero-lateral chest wall mobilization

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This technique has many procedures such as trunk torsion, rotation, and lateral bending . It not only affects the ribs and tissue, but also moves the costovertebral and facet joints. This pattern is very useful in ordet to improve the ventilation around in the lower lobe of both lungs..

Lateral chest wall mobilization

This technique can be applied in cases of unconsciousness and good consciousness. This part can be mobilized either by therapist likes lateral flexion on the bed, or rib torsion. Other procedures can be performed by passive stretching in sitting position. The last choice that is very strong and give the best result in order to stretching by side lying on the pillow and passive stretching. This pattern helps to improve the chest wall flexibility around the lower thoracic and improves the ventilation in both lower lungs. Sometime, lateral chesl wall stretching effects to the thoracic joints either sterocostal or costovertebral joints.

Indication and contra-indication of chest mobilization techniques

There has been no information on the indication for chest mobilization before, which gives a tendency for limitation of chest movement; either structurally or physiologically. However, this technique can be used for various conditions such as COPD, prolonged bed rest, abnormal spine, deconditioning and aging.

The contra-indications for using this method are listed below:

- Severe and unstable rib fracture
- Metastasis bone cancer
- Tuberculosis spondylitis
- Severe osteoporesis
- Herination

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- Severe pain
- Unstable vital signs

MECHANICAL AIDS

INCENTIVE SPIROMETRY

An **incentive spirometer** is a medical device used to help patients improve the functioning of lungs.

It is provided to patients who have had any surgery that might jeopardize respiratory function, particularly surgery to the lungs themselves, but also commonly to patients recovering from cardiac or other surgery involving extended time under anesthesia and prolonged in-bed recovery.

The incentive spirometer is also issued to patients recovering from pneumonia or rib damage to help minimize the chance of fluid build-up in the lungs.

The patient breathes in from the device as slowly and as deeply as possible, then holds his/her breath for few seconds. This provides back pressure which pops open alveoli. It is the same maneuver as in sigh. An indicator provides a gauge of how well the patient's lung or lungs are functioning, by indicating sustained inhalation vacuum.

The patient is generally asked to do many repetitions a day while measuring his or her progress by way of the gauge.

NIPPV

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(Non Invasive Positive Pressure Ventilation)

It includes continuous positive airway pressure (CPAP) and bilevel positive airway pressure (BiPAP)

CPAP

CPAP (Continuous Positive Airway Pressure) is a tool which can be used to assist the oxygenation of several respiratory pathologies

. CPAP is not a replacement for any medication or procedure, but a tool which can provide a high level of ventilatory support without the need for RSI or intubation.

Patients whose condition is resistant to parenteral medications but whose respiratory effort does not yet require intubation should be considered prime candidates for CPAP

Indications

Respiratory distress secondary to suspected congestive heart failure, acute cardiogenic pulmonary edema, pneumonia, and chronic obstructive pulmonary disease (asthma, bronchitis, emphysema).

Contraindications

- Unconsciousness
- Suspected pneumothorax %o
- Inadequate respiratory drive %o
- Shock/Hypotension
- Chest wall trauma %o

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- Persistent nausea/vomiting
- Has active upper GI bleeding or history of recent gastric surgery

Commonly Pressures used

Max 5 cm/H₂O for Bronchospasm

Max 10 cm/H₂O for CHF,

Pulmonary Edema, and Pneumonia. %

Max 5 cm/H₂O for pediatrics **BIPAP**

BiPAP:

This is an acronym for Bi-level (or Biphasic) Positive Airway Pressure. It provides a combination of both IPAP and EPAP.

- **IPAP.** This is Inspiratory Positive Airway Pressure. It is a pressure during inspiration that assists a patient obtain an adequate tidal volume. Because it provides assistance with inhalation, it therefore decreases the work of breathing required to get air in. Because it assures adequate ventilation, it is often prescribed to blow off carbon dioxide (CO₂).
- **EPAP.** This is Expiratory Positive Airway Pressure. It is the same thing as CPAP. EPAP is simply used here so you know your talking about CPAP on a BiPAP machine. EPAP is used to improve oxygenation.

Indications for BiPAP.

- Respiratory Failure due to accessory muscles fatigue. It assures adequate ventilation to blow off CO₂ and improve oxygenation.

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- COPD to decrease airway resistance, thereby decreasing work of breathing required to take in an adequate tidal volume. By increasing ventilations, it helps to blow off CO₂. It also keeps airways patent to improve oxygenation.
- Pulmonary Edema to help decrease cardiac output which decreases venous return to the right ventricle to reduce blood return to the heart. It also keeps airways patent to help improve oxygenation. It also helps keep alveoli patent to improve oxygenation (prevents alveolar collapse). By keeping alveoli patent, and redistributing alveolar fluid, it helps to reduce pulmonary compliance and reduce work of breathing.
- Atelectasis to help keep airways patent to improve oxygenation
- Pulmonary Embolism to improve oxygenation
- Pneumonia to assure adequate ventilations and oxygenation

Adjusting BiPAP settings. As a rule of thumb, the following rules are true.

IPAP. Increase to blow off CO₂. It should not be higher than 20 to prevent pressure from blocking the esophagus. By providing adequate tidal volumes it may also help improve oxygenation.

EPAP. Increase to improve oxygenation.

PS. Pressure Support. This is the gap between IPAP and EPAP. The greater the PS is the more CO₂ will be blown off.

Patient Leak. It is important to have a small leak to prevent skin breakdown. Most modern machines will compensate for a small leak.

Alarms. Adjusted as appropriate for each patient.

Contraindications for BiPAP include.

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- Inability of patient to protect own airway (decreased level of consciousness). This includes the inability of the patient to pull off the mask if it becomes full of fluid, such as vomit or spit.
- Increased secretions (i.e. pulmonary edema, increased sputum production)
- Any patient at risk of vomiting (post stomach surgery, drug overdose). Bullous lung disease (emphysema) because the high pressure may cause a pneumothorax
- Pneumothorax may be complication due to increased pressure;;may blow out rest of good lung
- Hypotension; High pressures decrease cardiac output
- Non-compliant patient. Surely you cannot force a patient to use this equipment.

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