Pulmonary rehabilitation is a broad spectrum program that aims at improving the physical and psychological well being of the people with chronic respiratory diseases. Lack of physical exercise leads to deconditioning of the muscles in diseases like chronic obstructive pulmonary diseases and asthma, which increases the severity of the perceived symptoms. The lack of activity can start up a vicious cycle which can lead to cardiac ailments and skeletal problems due to lack of movement. There is increase in the symptoms of perceived exertion and shortness of breath in patients.

Physical exercises have proved to be beneficial in especially in COPD rehabilitation by improving the functional capacity of the patients and help in conditioning of the muscle. Aerobic and resistance training exercises are widely used in pulmonary rehabilitation of chronic lung diseases. The major goal of physical rehabilitation is to improve the functional capacity and thus improve the health related quality of living of people with lung diseases.

**The goals of the pulmonary rehabilitation:**

1. To reduce the symptoms, disability, and handicap and to improve functional independence in people with lung disease.

2. The people undergoing physical rehabilitation are able to get maximum benefit from the medicinal treatment.

3. The rehabilitation process incorporates a physical, psychological, nutritional and functional aspects of an individual.
4. Rehabilitation is suitable to individual needs and is provided by a multiprofessional team with involvement of the patients’ family.

5. The outcome of the rehabilitation program should be measured by the level of disability, impairment and handicap.

**Causes of Dyspnea and exercise intolerance:**

1) Obstruction in airways during expiration or inspiration due to inflammation.

2) Weakness of the inspiratory muscles.

3) Cardiac dysfunctions.

Due to inefficient gaseous exchange in pulmonary conditions, there is hyperinflation of the lungs. Due to hyperinflation, the lungs are not able to increase their tidal volume during exercise, leading to exercise intolerance and weakness of the inspiratory muscles.

**Benefits of Pulmonary Rehabilitation.**

1. Exercise improves arterial venous oxygen ratio.

2. Respiratory rates are normalized and dyspnea is reduced.

3. Strength of expiratory and inspiratory muscles in improved.

3. Due to reduction in dyspnea exercise tolerance is improved. The mechanical efficiency of breathing is also improved and vital capacity is increased.

4. Overall quality of life is improved, symptoms of depression are relieved.

5. Ambulatory capacity of individual is improved.

6. Hospital stay is reduced.

**Comprehensive out-patient pulmonary rehabilitation: Treatment outcomes in early and late stages of chronic obstructive pulmonary disease.**


**Prescription of Exercise.**

Following variables should be assessed before exercise prescription.
1) **Individualization**: Exercise prescription should be according to type of COPD and severity of asthma condition. Studies emphasize that exercises that are specific to each individual, according to his disease prove to be more physiologically beneficial.

2) **Mode**: Any time of sustained aerobic exercise is recommended for pulmonary rehabilitation. Interval training in which there is gap period between two sets of exercises helps in increasing the exercise load. Lower Extremity activities like walking, jogging, rowing, cycling and swimming are recommended. Upper extremity exercises, arm ergonomics or free weight are also included.

3) **Intensity**: Heart rate, oxygen consumption and rating of perceived exertion are considered while prescribing the intensity of exercise. Exercises at both low and high intensity have shown to benefit in lung conditions, however the benefits of training increase with increasing the intensity. Again individualistic approach is always considered in prescribing exercise intensity.

4) **Duration**: Exercising with in target heart rate for at least 20 -30 minutes is recommended. If the patient is able to perform 20-30 minutes of continuous exercise within the target heart rate range, then 3-5 evenly spaced sessions are recommended. The duration of training session varies according to individual patient tolerance. Frequent rest periods can be provided with exercise to accomplish a total of 20 to 30 minutes of discontinuous exercise.

5) **Frequency**: The frequency of exercise depends on the other factors like intensity and duration. The weekly exercise prescription is more for patients with lower functional abilities.

**Rehabilitation in Lung diseases:**

A) **Techniques for the remove secretions from the lungs**: Accumulation of secretions in the lungs interferes with gaseous exchange in patients suffering from obstructive lung diseases. In COPD patients, before starting any exercise program secretions are removed from the lungs using various techniques so that patient is able to get maximum benefit from the exercise. Secretion removal techniques are of two types ; 1. **Passive** 2.**Active**: 

1. **Passive techniques for removal of secretions.**
i) **Postural drainage techniques:** In postural drainage techniques patient is positioned in such a way that gravity helps in the drainage of the secretions by assisting mucociliary transport system. There is a different drainage position for the specific lung segment involved. The bronchus of the lung segment having secretions is positioned perpendicular to the ground so that secretions are easily removed with help of gravity.
ii) **Percussion**: This technique is used to immobilize the secretions which are adherent to the inner walls of bronchus. A rhythmical force is applied with cupped hands to the chest wall of the patient. The technique is applied to the lung segment which has accumulated secretions. Percussion is administered for 3 to 5 minutes on each lung segment involved. Postural drainage and percussion techniques are often combined together to assist in removal of secretions along with coughing.

iii) **Shaking**: In this technique, a bouncing maneuver is applied over lung segment of the lung involved. After the mucous has been dislodged by using the above mentioned techniques. The airway is cleared using airway clearance techniques such as coughing and huffing.
2. **Active techniques for removal of secretions.** The patient is actively involved in secretion removal with minimal assistance from the therapist.

i. **Active Cycle of breathing techniques (ACBT):** It is a breathing exercise technique which the patient can perform independently. It involves breath control phase, thoracic expansion phase and forced expiratory technique to clear secretions from the airway. The secretions are pushed from smaller respiratory airways to larger respiratory airways using this technique. The secretions can be removed from the airways by coughing and huffing.

![Diagram of Active Cycle of breathing techniques (ACBT)]

ii. **Positive expiratory Pressure:** Positive expiratory pressure is the pressure that remains in the lungs at the end of expiration. One of the techniques to maintain positive expiratory pressure in the lungs is pursed lip breathing. It involves active expiration against resistance. Lips are slightly pursed as in whistling and the patient is instructed to expire slowly through the small opening. This procedure recruits respiratory muscles and develops positive pressure in the airways that prevents collapse of the smaller airways.
iii. **Ventilatory Muscle training**: Due to abnormal mechanics of breathing there is a deconditioning of expiratory and inspiratory muscles of the lungs in pulmonary dysfunctions. Ventilatory muscle training involves application of resistance during inspiratory or expiratory phases or both phases of ventilation to improve muscle strength and endurance of muscles of ventilation. Use of the ventilatory muscle training devices be made according to individual, type of disease, severity of the disease, motivation of the patient and progress made by the patient.
iv. Aerobic training: Aerobic training for patients with pulmonary conditions include the following steps: warm up, aerobic exercises and cool down periods. Before the exercises are started the vital signs of the patients are checked at resting levels, like heart rate, respiratory rate, blood pressure, weight and lung auscultations. If the FEV1 of the patient is less, a inhaler can be provided prior to beginning of the aerobic exercises. Stretching is performed to relax all the muscles of the body. During the warm period, exercises like cycling are performed which increase, the blood pressure and heart rate is slowly. The emphasis during the performance of aerobic training is on controlled breathing. The warm up periods consist of 5 - 15 minutes time. Which is followed by period of aerobic activities that can include cycling, walking, jogging, swimming etc. at appropriate intensities to maintain the target heart rate. Low level of aerobic exercises are performed for duration of 5 to 15 minutes that slowly returns the body to pre exercise stage.

v. Strength training: Strength of the respiratory muscles can be improved by incorporating exercises for upper and lower extremities. Similar exercises as used in aerobic training can be used at higher resistance level with lower repetitions. Weight training programs to improve strength of specific groups of muscles can be used. Again all the rehabilitation protocol to be followed should be specific to the individual.

Exercise and Asthma

There are findings that suggest a negative relationship between exercise and asthma. Also many studies indicate that patients with asthma have a lower level of fitness in relation to the severity of disease. A study has indicated that people with asthma are 2 standard deviations below normal on endurance testing. A study by Clark and Cochrane studied 64 young adults and found that, the mean oxygen consumption was lower for asthmatics at same heart rate than controls. The findings signify a low level of fitness in asthmatic patients. The risk of developing cardiorespiratory diseases is also increased in asthmatics due to lower fitness levels.

The individuals suffering from asthma require specially designed rehabilitation program to avoid secondary effects of the disease. The rehabilitation program is designed according the patient. One of the approach suggests to improve cardiorespiratory fitness of the patients by getting involve in indoor aerobic training program, in temperature and humidity controlled enviroment. The training is to be done with in the target heart rate range and is to be closely monitered to avoid exacerbations of the symptoms. A prior dosage of beta-2 agonist can be used to avoid asthmatic attack. The second approach for the patients who can not take part in aerobic activity is to be involved in peripheral muscle strengthening program to avoid deconditioning of the muscles. A low intensity strength and endurance training can maintain the normal condition of muscles. It can involve breathing retraining exercises, walking at maximal tolerable speed.

References:


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