UNIT NO. 5

PULMONARY REHABILITATION

Dr Ong Kian Chung

ABSTRACT

Pulmonary rehabilitation identifies and treats the systemic effects of the disease and the positive outcomes are realised without demonstrable improvements in lung function. It is multidisciplinary, patient centred and provides a comprehensive assessment upon which the three components of exercise training, self-management education, and psychosocial/ behaviour intervention are conducted over a period lasting 6 to 12 weeks. Pulmonary rehabilitation administered after hospital admission for an exacerbation was shown to be able to improve quality of life, improve exercise capacity, and also reduce re-exacerbation and hospital admission. Self-management education may promote long-term adherence to the exercise program.

Keywords: system effects, positive outcomes, lung function, exercise training, self-management education, psychosocial intervention

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INTRODUCTION

Pulmonary rehabilitation has emerged as a standard of care for patients with COPD. Its use improves the wellbeing and quality of life of patients.

DEFINITION

Pulmonary rehabilitation is a multi-dimensional continuum of services directed to persons with pulmonary disease and their families, and usually delivered by an interdisciplinary team of specialists, with the goal of achieving and maintaining the individual's maximum level of independence and functioning in the community [National Institute of Health (NIH) Workshop on Pulmonary Rehabilitation Research].

Pulmonary rehabilitation leads to improvements in dyspnoea, exercise capacity, and health related quality of life. Table 1 shows the outcomes of pulmonary rehabilitation.

EFFECTS OF PULMONARY REHABILITATION

It needs to be pointed out that the beneficial effects of pulmonary rehabilitation are achieved without demonstrable effect to the forced expiratory volume in one second (FEV_1) – a variable used to measure severity of COPD. This paradox can be explained: pulmonary rehabilitation (PR) treats the systemic effects of COPD and its comorbidities and in that way brings relief even though the FEV_1 remains unchanged.(Nici et al, 2010)[3]

- PR reduces peripheral muscle dysfunction that has accumulated from physical inactivity, systemic inflammation, and muscle wasting.
- Exercise training reduces lactate production and in that way decreases ventilatory burden.
- Reduction of ventilatory dyspnoea in turn allows the patient to breathe more slowly during exercise thereby reducing dynamic hyperinflation.
- When there is less exertional dyspnoea, the mood is uplifted, and the patient feels better.

Even though there is no change in FEV_1, there is improvement is the 6MWD test, and also improvement in VO2. These have also been demonstrated in a small local study of 34 patients after completing a 3 month pulmonary rehabilitation programme (Ong et al, 2001)[4]. As is expected, FEV1 did not change. The severity of COPD, including its symptom burden, is clearly influenced by more than air flow limitation alone.

FACTORS RELATED TO MORTALITY IN COPD

Six minute walking distance (6MWD). This distance is found to be related to 1 year survival based on a study of 198 patients with severe COPD. Those able to walk less than 100 metres in 6 minutes had 85% mortality, compared to 35% in those who can walk 201-300 metres, and 20% in those who can walk 401-500 metres (Pinto-Plata et al 2004)[5]. This test predicts mortality better than other traditional markers of disease severity.

Exercise capacity (Peak VO2) and Health status. The Peak oxygen uptake (Peak VO2) remains the gold standard measurement of exercise capacity and has been associated with survival in COPD. Health status can be measured by the Chronic Respiratory Disease Questionnaire (CRQ) or the St George's Respiratory Questionnaire (SGRQ) or Breathing Problems Questionnaire (BPQ).

Oga et al demonstrated the significant relationships of exercise capacity and health status to mortality in COPD patients, independent of FEV_1, or age. Laboratory exercise capacity using the cycle test could be the most significant predictor of mortality in COPD. With respect to health status, the ability of the CRQ to predict mortality was weaker than the SQRQ or BPQ. This study shows the multidimensional evaluation of the disease severity in COPD from the perspective of mortality can be potentially useful (Oga et al, 2003)[6].

The BODE index. Chronic obstructive pulmonary disease (COPD) is characterised by an incompletely reversible limitation in airflow. A physiological variable - the forced

ONG KIAN CHUNG
Respiratory Physician, Mount Elizabeth Medical Centre, Singapore

expiratory volume in one second (FEV1) - is often used to grade the severity of COPD. However, patients with COPD have systemic manifestations that are not reflected by the FEV_1. The BODE index is a multidimensional grading system that assessed the respiratory and systemic expressions of COPD and predicts outcome in these patients. Four factors were found to predict the risk of death in COPD: the body-mass index (B), the degree of airflow obstruction (O) and dyspnea (D), and exercise capacity (E), measured by the six-minute-walk test. These variables are used to construct the BODE index, a multidimensional 10-point scale in which higher scores indicate a higher risk of death (Celli et al, 2004)[7]. The BODE index predicted the risk of hospitalisation in patients with COPD (Ong KC et al, 2005)[8].

THE PLACE OF PULMONARY REHABILITATION PROGRAMME

The optimal therapy of a COPD patient usually requires a combination of pharmacological and non-pharmacological therapies. Pulmonary rehabilitation is an important part of care in the patient who has moderate (Stage II) or more advanced disease.

PR provides a mode of integrating care, complementing otherwise standard medical therapy, and producing significant gains across multiple outcome areas of importance to the patient e.g. increase in the distance that the patient can walk in the 6MWD, subjectively also less dyspnoea, and a better sense of wellbeing. Pulmonary rehabilitation has also been shown to reduce further exacerbations and hospital admissions in the post-exacerbation COPD patient.

COMPONENTS OF PULMONARY REHABILITATION

Pulmonary rehabilitation begins with a comprehensive assessment. The following three components of pulmonary rehabilitation programme are then introduced:

- Exercise Training
- Self-management Education
- Psychosocial/ Behaviour Intervention

Although individual programmes vary widely, most outpatient programmes include 2-3 hours of education and exercise per session, three times weekly for 6-12 weeks.

Exercise Training

Exercise training is essential in pulmonary rehabilitation. COPD can be considered a disease with disease of the peripheral muscles as a co-morbidity. There is decreased mass, alterations in fibre-type distribution, and decreased metabolic capacity contributing to exercise intolerance. These abnormalities may be reduced by comprehensive exercise training (Nici et al, 2010)[3].

The evidence based guidelines on exercise training in COPD patients from the ACC/AACVPR1 are shown in Table 2. Exercise training is based on general principles of intensity (higher intensity produces greater results), specificity (only those muscles trained show an effect), and reversibility (cessation of regular exercise training results in a decrease in training effect).

Higher levels of exercise training are associated with a physiologic training effect, dose-dependent increases in oxidative enzymes in ambulatory muscles, and greater improvement in exercise performance. Although patients with COPD often have ventilatory limitations to maximal exercise, a physiologic training effect can be achieved if high training targets are used. Exercise intensity of 60 to 80 percent of the patient's peak work rate is often feasible.

Strength training is also an important component of exercise training and may yield additional benefits. Patients who cannot tolerate high levels of exercise training can also benefit from strength training. Maximising bronchodilation, interval training (i.e., alternating high and low intensities), and oxygen supplementation may allow for higher intensity exercise training in some patients.

The optimal duration of training depends on the progress of the individual patient. Guidelines from the Global Initiative for Chronic Obstructive Lung Disease state that six weeks (with three sessions per week) is the minimum duration of an effective program, but longer duration confers greater benefits.

Self-management education

Self-management education promotes self-efficacy and encourages active participation in health care. The objectives are to improve health status and reduce health care utilisation. It is provided both in small group settings as well as one-on-one. format. An initial evaluation helps determine educational needs, which are then reassessed during the course of the program. Discussion about early recognition and treatment of COPD exacerbations helps in self-management. Advance care planning should also be touched on at some time.

Psychosocial/behavioural intervention

Anxiety, depression, coping problems, and decreased self-efficacy contribute to the burden of advanced respiratory disease. There is evidence that PR results in small to moderate improvements in anxiety and dyspnoea (Nici et al, 2010)[3]. Psychosocial and behavioural interventions involve educational sessions or support groups that focus on coping strategies and stress management. Patients' family members and friends are also encouraged to participate in these support groups. Patients with substantial psychiatric disease should be referred for appropriate care.

TABLE 1. OUTCOMES OF PULMONARY REHABILITATION	
Dyspnoea relief	Strong evidence, strong recommendation (ACCP/AACVPR)[1] Evidence grade A (GOLD)[2]
Improved exercise performance	Strong evidence, strong recommendation (ACCP/AACVPR)[1] Evidence grade A (GOLD)[2]
Improved health related quality of life	Strong evidence, strong recommendation (ACCP/AACVOR)[1] Evidence grade A (GOLD)[2]
Psychosocial benefits	Moderate evidence, weak recommendation (ACCP/AACVOR)[1] Reduced anxiety and depression; evidence grade A (GOLD)[2]
Reduced health care utilisation	Moderate evidence, weak recommendation ((ACCP/AACVOR)[1] Evidence grade A (GOLD)[2]
Survival	Insufficient evidence; no recommendation provided (ACCP/AACVOR)[1] Evidence grade B – limited data (GOLD)[2]
Source: Nici et al, 2010[3] Footnote: (ACCP/AACVPR)1 = Ries et al, 2007 – ACCP = American College of Chest Physicians; AACVPR = American Association of Cardiovascular and Pulmonary Rehabilitation. (GOLD)2 = Global Initiative for Chronic Obstructive Lung Disease, 2010	

TABLE 2. EXERCISE TRAINING IN PATIENTS WITH COPD	
Recommendation	**Strength of evidence**
Lower-extremity exercise training should be a mandatory component of pulmonary rehabilitation.	Strong evidence; strong recommedation
Lower-extremity exercise training performed at a high level of intensity produces greater physiologic benefits than lower-intensity training.	Moderate evidence; strong recommedation
Unsupported upper-extremity endurance training should be included in pulmonary rehabilitation exercise programs	Strong evidence; strong recommedation
Low- and high-intensity exercise training produces clinical benefits for patients with COPD.	Strong evidence; strong recommedation
Including a strength training component in a pulmonary rehabilitation exercise program increases muscle strength and muscle mass.	Strong evidence; strong recommedation
There is no evidence to support the routine use of inspiratory muscle training as an essential component of pulmonary rehabilitation.	Moderate evidence; strong recommedation
Source: Nici et al, 2010[9]; Ries et al, 2007[1]	

POST-EXACERBATION REDUCTION OF EXACERBATIONS

Exacerbations of chronic obstructive pulmonary disease (COPD) are characterised by increased dyspnoea, reduced quality of life and muscle weakness. PR administered after hospital admission for an exacerbation was shown in a small study of 60 patients to be able to improve quality of life and exercise capacity and also reduce re-exacerbation and hospital admission. (57% admission in the usual care group compared to 7% in those receiving post-exacerbation pulmonary rehabilitation) (Seymour et al, 2010)[9].

MAINTAINING BENEFITS AND INTEGRATING CARE

The positive outcomes from pulmonary rehabilitation tend to diminish over months to years after discontinuation of the program. Self- management education may promote long-term adherence to the exercise program. Although patient selection and assessment, exercise training, self-management education, and psychosocial support make up an interdisciplinary pulmonary rehabilitation program, these components should be integrated into lifelong COPD management for all patients. The primary care physician is in a vantage position to provide and coordinate this type of care by integrating care with the specialist, allied care people, patient and significant others.

CONCLUSION

- Pulmonary rehabilitation is now recognised as important and has increasingly emerged as a standard of care for patients with COPD.

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LEARNING POINTS

- **Pulmonary rehabilitation identifies and treats the systemic effects of the disease and the positive outcomes are realised without demonstrable improvements in lung function.**
- **It is multidisciplinary, patient centred and provides a comprehensive assessment upon which the three components of exercise training, self-management education, and psychosocial/behaviour intervention are conducted over a period lasting 6 to 12 weeks.**
- **Pulmonary rehabilitation administered after hospital admission for an exacerbation was shown to be able to improve quality of life and exercise capacity and also reduce re-exacerbation and hospital admission.**
- **The positive outcomes from pulmonary rehabilitation tend to diminish over months to years after discontinuation of the program.**
- **Self- management education may promote long-term adherence to the exercise program.**