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Original Article

Proposed Protocol for Developing a Rehabilitation Program for Chronic Obstructive Pulmonary Disease Patients in Saudi Arabia

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Abstract

Pulmonary rehabilitation (PR) has a vital role in the treatment of symptomatic patients with chronic obstruction pulmonary disease (COPD) therefore activating PR should be considered in medical care systems. In Saudi Arabia (KSA) prevalence of COPD is more than 2.4 % and factors cause COPD are numerous. The purpose of this paper is to provide a rationale for establishing PR program for COPD in KSA by be achieved by an assessment of available resources and using theory, evidence, and clinical guidelines to allow for supporting the creation of PR program for COPD. The review will also include a description of the program and a comparison with literature-based citations and accounts of local resources that are available. In addition, the proposal will also include the objective, location and equipment, patient assessments, exercise training and educational programs. In addition, models of delivering PR and program evaluation will be provided for PR program of COPD population.

Keywords: Chronic Obstructive Pulmonary Disease, Pulmonary Rehabilitation, Exercise Prescription.

Introduction

A brief overview of the population in Kingdom of Saudi Arabia (KSA) supports the need for establishing and creating a chronic obstruction pulmonary disease (COPD) pulmonary rehabilitation (PR) program. It has been shown that at least 2.4 % of Saudis suffer from COPD (Wali et al., 2014). In addition, the study by Jaber (2022) showed that between 1990 and 2019 The incidence of COPD steadily raised demonstrating an increase of 49%. The study by Prescott and Vestbo (1999), and the World Health Organization (2015) demonstrate that smoking; air pollution, use biomass for energy and indoor air pollution with poor ventilation are the main causes of COPD disease. Many of these factors are present today in KSA. The prevalence of smoking tobacco represents a high risk for COPD at a rate of approximately 17.5 % of the Saudi population (General Authority for Statistics, 2023).Furthermore, the high level of air pollution (Saudi Presidency of

Meteorology and Environment, 2014), occupational exposure to organic and non-organic dust, passive smoking and use biomass fuel for cooking with poor ventilation in KSA leads to increase prevalence of COPD (Khan at al., 2014).

As a result, many individuals require the medical attention that a pulmonary rehabilitation program can provide. These can be done in hospitals as outpatients. Since there is massive and substantial need for these programs and the population is significant, there are numerous benefits that can be attributed from long term care and therapy. This has been confirmed by a study which reveals that PR programs in KSA are feasible and achieve better outcomes and integral treatment modality for COPD patients (Al-Moamary,2008; Aldhahir et al, 2021).Furthermore PR is potential to be a cost-effective medical care (Lamberton and Mosher,2024) and this is compatible with vision of KSA 2030.

The increased occurrence of COPD and the associated risk factors when combined with the existence of the basic components required for establishing a proposed PR program is feasible in KSA. When these factors are combined with the fact of a rising COPD population provides impetus for PR program to be established and developed in this country.

Description of the proposed program

PR program will be designed to provide the maximum positive outcomes for patients with COPD in KSA. This project will demonstrate numerous variables accounting for the major deficiencies that a patient may experience. As a result of the significance of these variables it becomes clear why a PR program is applicable and confident based on protocols and literature.

Objective

The objective of this program design is to enhance the overall well-being and management of individuals with COPD. The program aims to increase exercise tolerance, thereby improving physical capacity and reducing the severity of COPD symptoms. It seeks to prevent further complications associated with the disease, enhance the quality of life, and enable greater participation in daily activities. Additionally, the program focuses on building self-management skills among patients to empower them in managing their condition effectively. Another critical goal is to reduce the rates of hospitalization and readmission, ultimately leading to better health outcomes and reduced healthcare costs.

Equipment and location

The program will be designed in a Gums of outpatient rehabilitation departments in a hospital in KSA. The program requires the following equipment: a flat straight area for walking, a pulse oximeter, measure blood pressure, hand weights, TheraBand, stairs, stopwatch/timer, stethoscope, supplementary oxygen, nasal prongs, modified Borg dyspnea scale, a stationary bicycle, a treadmill, weights machines, and an arm crank ergometer (The Australian lung Foundation, 2024).

Patient Assessment

The inclusion criteria for patients require a current diagnosis of COPD, the presence of dyspnea or other respiratory symptoms, and a stable condition with a Forced Expiratory Volume (FEV) of 50 percent or less. Additionally, patients should have mild to moderate hypoxemia or limitations in exercise tolerance, muscle force, occupational performance, and impaired activities of daily living. Conversely, patients will be excluded if they have an infectious chest disease, severe psychotic disturbance, cognitive impairment, uncontrolled cardiovascular diseases or diabetes, or inability to train due to musculoskeletal or neurological disorders, or severe hypoxemia not correctable by oxygen therapy.

Referral system

Patients are referred to PR program from the outpatient pulmonary clinic in KSA. This referral can come from the Respiratory specialist surgeons or pulmonologist .After referral to the program, the coordinator (i.e. physiotherapist) will review the

eligibility of the patient and then invite the patient to attend via a phone call or sms message.

Medical history and initial assessment

A detailed medical history is required including details of the severity of patient prognosis, comorbidities, previous hospitalization, dyspnea, smoking history, and Spirometry scores (Kuzma et al., 2008). However, some information may require further investigation by a physical examination such as blood pressure (BP), pulse rate, respiratory rate, heart rate (HR),oxygen saturation(SPO2) and Requirement for oxygen therapy that can be assessed by a physiotherapist (The Australian lung Foundation, 2024; Corhay et al., 2014).

In addition, a dietician can assess the patient's nutritional status including Body Mass Index (BMI) that will give information according to the nutritional state of the patient (The Australian lung Foundation, 2024). In addition, a Psychotherapist will assess the patient's mental health to address the problem of anxiety and depression by generic psychiatric screening tools (The Australian lung Foundation, 2024).

Exercise tests

Table 1 provide the guidelines for assessing exercise capacity will be considered during the initial assessment for entry to the program by a physiotherapist, which will include The Six-Minute Walk Test (6MWT) to determine exercise tolerance and assess exercise capacity to COPD patients (American Thoracic Society, 2002; The Australian lung Foundation, 2024; Translation Research Evidence and Knowledge, 2010).

Also, an assessment will be made of quality of life by using questionnaires (The Australian lung Foundation, 2024) which includes the St George's Respiratory Questionnaire that will evaluate quality of life tasks according to respiratory function ability (The Australian lung Foundation, 2024).

Finally, a physiotherapist will evaluate shortness of breath (dyspnea) before and after the PR program using the Modified Medical Research Council Scale. The Modified Borg Scale will also be used to evaluate Breathlessness during the tasks (The Australian lung Foundation, 2024).

Table: Guidelines for Performing the 6-Minute Walk Test (6MWT)

Space	-Corridor same level flour. -should be 30 meters long. -easy access to a telephone, resuscitation trolley, oxygen, and BP machine. -enough quit for the patient to clearly listen the instructions -A chair must be available for the patients.
Equipment	- Cones - Stopwatch - Lap counter -pen and worksheet - Measuring tape
Pretest	-Patient should wear comfortable clothing and appropriate footwear and have his or her medications (e.g. inhalers, GTN spray etc.) - physiotherapists allow to patient at least 15 minutes before beginning the 6MWT
Performing the 6MWT	-Set the watch to 6 minutes -Prepare all materials (cones, worksheets, chair etc.) -the instruction should be giving to patient -Position the patient at the starting line and start the test. -During the test, each minute physiotherapist tells the patient how many minutes remaining and ask her or him if feel any problem. -finish test at the sixth minute.

	-If the patient stops walking during the test, provide him or her another chance to continue -if the patient refuses to continue, physical therapist should stop the test. -at end the test physiotherapist will record total distance by meter, SpO2,HR,BP, and dyspnea.
Interpretation results of 6MWT	Physiotherapist will convert the result of 6MWT to exercise intensity as the following equation 6-minute walk distance 6MWD)/6 = Distance in 1 minute Distance in 30 minutes = 1minute distance x 30 For example, If the patient walked 300 meters in six minutes: One minute distance = 300 ÷ 6 = 50 meter. 30-minute distance = 50 x 30 = 1500 meter. Speed of patient is 1500÷30=50 meter per minute.
Safety Considerations	-during test resting heart rate of patient must be less than 120, systolic BP less than 180 mmHg, and a diastolic BP less than 100 mmHg. -monitoring BP before and after the test. -The physical therapist administering the test should be trained in basic life support - in event of Patient Stops During 6MWT 1- allow patient sit on chair 2-ask patient reason of stopping 3 Measure the SpO2% and HR 4- Provide patient another chance to continue if Once SpO2 >= 85% and patient feel able.
Termination test	Stop the Test if Any of the Following happen: Chest pain, confusion, headedness, muscle fatigue or SpO2 < 80%.

Model of PR

The structure and the setting of the PR program will be conducted as an outpatient in a rehabilitation department in hospitals. The minimum duration of PR is usually 6 weeks including 20 sessions to achieve an acceptable physiological effect (Corhay et al., 2014). However, the best duration of a PR Outpatient program to achieve the maximum benefit is 12 weeks and contains 3 sessions a week with each session of approximately 30-45 minutes (Spruit et al., 2013).

Education

Patient education is a fundamental component for an effective comprehensive PR program (The Australian lung Foundation, 2024). The benefits of education include assisting patients to be active members in their own health, assisting patients and their families pick up a better comprehension of the physical and mental changes that happen with COPD and helping patients and their families in their rehabilitation (The Australian lung Foundation, 2024).

Educational session will be delivered by telecommunication programs such as teams, zoom and Webex etc. including the use of PowerPoint, video, or tables of contents . The educational class must not include more than 15 patients and not last longer than 2 hours to keep it enjoyable and achieve the maximum benefit. The educational program must be started in early weeks of the PR program. The program will be designed according to the needs of the patients and staff expertise. The common contents of effective educational programs include core and elective topics (The Australian lung Foundation, 2024).

Core education topics

- Self-Management: including knowledge, benefit, principles of self-management and practical application. (The Australian lung Foundation,

2024; Corhay et al., 2014). This session can be facilitated by a social worker and psychologist

- Disease education: including COPD process, risk factors, diagnosis and monitoring of COPD, management of COPD (The Australian lung Foundation, 2024). A respiratory nurse or medical officer can deliver this session.
- Medications: including action, side effects and use of equipment and cleaning. (The Australian lung Foundation, 2024). This can be facilitated by a pharmacist.
- Managing Breathlessness: including evaluating their level of breathlessness and methods to control dyspnea delivered by a physiotherapist (The Australian lung Foundation, 2024).
- Physiotherapy skills: physiotherapist can teach patients about the type and prescription of exercise to be used, breathing techniques, precautions, and safety for exercise (Langer et al., 2009).
- Nutrition and Healthy Eating: dietician should provide information about energy food intake, healthy diet and correlation between height and weight (i.e. BMI) (The Australian lung Foundation, 2009).
- Psychological support including assessing managing and relaxation techniques for stress, anxiety and depression which may be facilitated by a psychologist or social worker (Corhay et al., 2014).

Optional education topics

- Airway Clearance: Signs and symptoms of an infective exacerbation, sputum expectoration techniques and role of humidification. This information can be provided by physiotherapist (The Australian lung Foundation, 2024).
- Continence: a continence or respiratory nurse can educate patients about risk factors and causes of continence and how it can be managed (The Australian lung Foundation, 2024).
- Home Oxygen: Indications for oxygen prescription, oxygen delivery systems, safety guidelines and travel with oxygen. A doctor or physiotherapist (The Australian lung Foundation, 2024) may facilitate these instructions.

Exercise

A reduction in exercise tolerance is the main problem in individuals with COPD (Sin & Man, 2006). Consequently, exercise training should be considered in the PR program. Exercise training will be conducted in the main gym in the rehabilitation departments. The exercise training will be prescribed based on the patient's results from tests of exercise strength and endurance capacity, and it must include Intensity, Duration, Frequency and Mode (The Australian lung Foundation, 2024).

Stretching exercise

Stretching exercises for legs and arms pre and post exercise assist to prepare the muscles for activity and prevent muscle strain and injury. Furthermore, regular stretching raises flexibility and increases the range of motion (Exercise is Medicine Australia, 2014). The table below provides prescriptions for stretching exercise for a patient with COPD.

Endurance training

Endurance training assists COPD patients in terms of strengthening muscle and improving fitness and breathing. This helps patients to do extra exercise without fatigue and breathlessness. Patients usually use cycling or walking exercises in this program (Spruit et al., 2013).

Endurance taring protocol could be divided into continuous or interval training. Recent studies reveal no clinically important differences between continuous or interval training (Beauchamp et al., 2010; Zainuldin et al., 2011). However, one study showed that interval exercise has better feasibility particularly in severe cases to avoid frustration during training (Gloeckl, Marinov, & Pitta, 2013). The table below provides prescriptions for endurance exercise for a patient with COPD.

Strength and Resistance exercise

Strength or resistance exercise is an important part of exercises included in a pulmonary program. They must be considered to assist COPD patients in terms of increased muscle mass, strength, and activities of daily life, and reduce risk of fall and breathing problems (Spruit et al., 2013). **The** table below shows the prescribed strength exercises for COPD patients.

Table: Guidelines for Stretching, Endurance, and Strength Training Exercises

Type	Mode	Intensity	Duration	Frequency
Stretching Exercise	Static Stretching	Low to moderate; according to capability and function of patient	30 seconds minimum for each static stretch.	with aerobic or strength training
Upper limb endurance training	arm cranking ergometer training	as the weight that the patient can raise 15 times	15 repetitions 3 set, approximately 10 minutes.	2-3 times per week.
Lower limb endurance training	Treadmill or Walking training	80% average speed on 6MWT 3 to 4 on the Modified Borg Scale	30 minutes	Continuous or interval
Upper limb strength exercise	exercise with free weights and elastic bands.	40%-50% 1RM	10 repetitions 1-4 set	2-3 times per week
Lower limb strength exercise	exercises with or without weights	40%-50% 1RM	10 repetitions 1-4 set	3-day week on alternate days.

Oxygen supplementary

Oxygen supplementation during exercise can be used for COPD patients with hypoxemia. It improves peripheral muscle oxygenation and exercise capacity (Vogiatzis et al., 2009) and maintains SPO2 above 90% (Corhay et al., 2014). If SPO2 of patient decrease below 80% during exercise, oxygen therapy must be used (The Australian Lung Foundation, 2024)

Adherence

Poor adherence can lead to increasing average morbidity, health care expenditures, prolonged stay in hospital as well as a decrease in the effectiveness of therapy and reduced quality of life. Therefore, adherence should be considered for both providers and patients to optimize disease management (Bourbeau & Bartlett, 2008).

Maintenance program

After the patient is discharged from the PR program, health staff will need to have a plan for maintaining the exercise capacity and quality of life of patients. Patients will need to continue to do exercises for 4 to 5 days per week unsupervised at home with regular reviews every 3 to 6 months to keeps patients on track (The Australian lung Foundation, 2024).

Program Evaluation

Program evaluation depends on the assessment pre and post the program. Preferably, one year after program completion. Furthermore, assessment of the effectiveness of pulmonary rehabilitation programs will be based on:

Evaluating patient outcomes when he or she has completed the program exercise test will include 6MWT Test which must be repeated to assess the changes in functional exercise capacity after PR for patients.

In addition, SPO2 and Dyspnea scores should be recorded pre and post 6MWT (The Australian lung Foundation, 2024). In addition, patients should be evaluated by constant work rate test at baseline at initial assessment and end of program to assess effectiveness of therapeutic interventions (Casaburi et al., 2005).

Furthermore, quality of life questionnaire such as the St George's Respiratory Questionnaire should be repeated at the end of the program (The Australian Lung Foundation, 2024).

Patient feedback serves as a valuable tool for quality control, allowing for the evaluation of which components of pulmonary rehabilitation (PR) patients find most beneficial. When collecting feedback, healthcare staff should ensure patients do not feel compelled to give positive responses. It is important to de-identify patient responses to satisfaction questionnaires to alleviate any concerns. The satisfaction-related questions should accurately reflect the content of the PR program. Additionally, the questionnaires should offer diverse response options, such as Likert scales, to avoid biased results and provide more comprehensive insights beyond simple yes or no answers.

Conclusion and recommendation

The prevalence and risk factors of COPD in KSA is high. The strategies to improve the health of individuals with COPD are necessary. PR play essential role in managing population with COPD and has been shown that can be performed in rehabilitation departments of hospital in KSA . This review has provided a guidance to hospitals to establish and deliver PR program.

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