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Review Article

Pulmonary Telerehabilitation Clinical Studies for Chronic Obstructive Pulmonary Disease Patients

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Abstract:

Pulmonary rehabilitation (PR) is an effective intervention for improving the health andquality of life of patients with chronic obstructive pulmonary disease (COPD). However, manybarriers limit the access and adherence to PR, especially in low-resource settings. Telerehabilitation, which uses information and communication technologies to deliver rehabilitation services remotely, may offer a feasible and acceptable alternative to conventionalPR. This review aims to synthesize the literature on the effectiveness, safety, and satisfaction of telerehabilitation for COPD patients. We searched various databases and identified 21 articles that met our inclusion criteria. We categorized the articles into three subtopics: benefits,challenges, and reasons for the lack of telerehabilitation. We found that telerehabilitation can improve exercise capacity, symptoms, health status, and psychological well-being of COPD patients as well as reduce hospitalizations and emergency department visits. However, there are also technical, organizational, and personal barriers that hinder the implementation and uptake of telerehabilitation. Moreover, there is a lack of evidence on the cost-effectiveness, long-term outcomes and optimal models of telerehabilitation for COPD patients.

Keywords : *Pulmonary rehabilitation ,COPD ,Telerehabilitation, Barriers and facilitators, Effectiveness and satisfaction*

Introduction

A progressive lung disorder known as chronic obstructive pulmonary disease (COPD) is characterized by persistent respiratory symptoms and an airflow limitation that is not easily reversible. Around the world, COPD is a common cause of morbidity and mortality. The prevalence of COPD from the eight studies ranged from 2.4% in a cross-sectional study done by Johnson et al. [1] in Southern India, to 16.1% by Koul et al. [2] conducted in Northern India. The random-effects pooled estimate for the prevalence of COPD among the Indian population was 7.4% (95% CI: 5.0%–9.8%).

Pulmonary rehabilitation (PR) is a crucial component of the care for COPD patients. PR can decrease COPD exacerbations, hospitalization, unexpected hospital visits, symptoms of dyspnea, leg pain, anxiety, and sadness, as well as the expense of medical care for COPD patients. PR greatly enhances COPD patient's ability to exercise, as well as their muscle strength and endurance, emotional function, health-related quality of life, ability to control their condition nutritional status and the likelihood of increasing their physical activity. According to studies people with COPD often live inactive lifestyles because of the persistent respiratory symptoms like cough and shortness of breath. There is a link between the decline in physical activity and poorer quality of life, more frequent use of medical services due to exacerbation and lower survival rates.

Tele-rehabilitation is defined as the provision of medical and rehabilitation care who are in need of rehabilitation through telecommunications and the internet. Telerehabilitation is an excellent way to ensure access to healthcare not only in economically advantaged metropolitan settings but also in remote and economically challenged environment. It is especially beneficial for people with disabilities who have mobility impairments, impairments in activities of daily living, sensory impairments, motor impairments, and cognitive impairments that make it most difficult to travel for appointments. It can overcome the barriers of distance and time to access patients with temporary and permanent disabilities and provide accurate diagnosis and prescription by a physical therapist. The purpose of this review was to provide a narrative synthesis of literature of studies, which use telehealth to provide pulmonary rehabilitation for chronic obstructive pulmonary disease (COPD) patients.

This review will include 21 articles about pulmonary telerehabilitation with COPD patients. These articles will divide into 3 subtitles. 9 articles under the first subtitle which talk about the benefits of pulmonary telerehabilitation. 6 articles for the second subtitle which is lack of pulmonary telerehabilitation. And 6 for the last subtitle which talk about the reasons behind the lack of pulmonary telerehabilitation.

Lack of pulmonary of telerehabilitation

1. Late Breaking Abstract-1-year follow-up of pulmonary tele-rehabilitation versus conventional pulmonary rehabilitation: A multicenter, single blinded, superiority RCT.

This study aimed to evaluate the long-term superiority of pulmonary tele-rehabilitation (PTR) over conventional pulmonary rehabilitation (PR) in people with severe COPD and high symptom burden. The study was a multicenter, single blinded, superiority RCT that enrolled 134 participants who were randomized to

either PTR or PR for 10 weeks. The primary outcome was walking capacity measured by the six-minute walk distance (6MWD) at 12-month follow- up. Secondary outcomes included symptoms, quality of life, physical activity level, mortality and hospitalizations. The results showed no significant difference between PTR and PR for 6MWD or any of the secondary outcomes at 12-month follow-up. Neither intervention maintained the short-term improvements achieved after the intervention. The study concluded that PTR was not superior to PR at 12-month follow-up and that both interventions had similar limitations regarding long-term sustainability.

2. 12-months follow-up of pulmonary tele-rehabilitation versus standard pulmonary rehabilitation: A multicentre randomised clinical trial in patients with severe COPD.

This study compared two types of PR for patients with severe COPD: standard outpatient PR and online supervised home-based tele-rehabilitation. The primary outcome was the 6 MWD after completion of the programme and at 12 months. The secondary outcomes were hospitalisation and mortality rates. The study found no significant differences between or within the groups in the 6MWD at any time point. There were also no significant differences in hospitalisation or mortality rates between the groups. The authors concluded that tele- rehabilitation was as effective as standard PR in maintaining physical capacity and reducing hospitalisation and mortality in patients with severe COPD. They suggested that tele- rehabilitation could be a viable alternative to standard PR for this population.

3. Comparison of telehealth versus centre-based pulmonary rehabilitation in clinical practice.

This study compared the outcomes of telehealth PR and centre-based PR in people with chronic respiratory disease who completed 6-8 weeks of supervised exercise and education. Telehealth PR involved once-weekly telephone or video calls from a clinician guiding patients on home-based exercise, while centre-based PR involved twice-weekly in-person sessions at a hospital. The study found no significant differences between or within the groups in functional capacity, dyspnea, or HRQoL at the end of the intervention. However, more patients reported improvement in their overall condition after telehealth PR than after centre-based PR. Both modes of PR were feasible and safe in clinical practice. The study concluded that telehealth PR was a suitable alternative to centre-based PR for people with chronic respiratory diseases.

4. Telerehabilitation versus traditional centre-based pulmonary rehabilitation for people with chronic respiratory disease: protocol for a randomised controlled trial.

This study's protocol outlines the design for a randomized controlled trial comparing telerehabilitation with traditional center-based pulmonary rehabilitation for individuals with chronic respiratory disease. The aim is to assess the effectiveness and feasibility of telerehabilitation as an alternative to in-person rehabilitation programs. The study will recruit a sample of adults diagnosed with chronic respiratory conditions such as COPD or asthma. Participants will be randomly assigned to either the telerehabilitation group or the traditional center-based rehabilitation group. Outcome measures will include respiratory function, exercise capacity, quality of life, and patient satisfaction. The study's findings will contribute to the understanding of telerehabilitation's potential benefits and limitations for individuals with chronic respiratory disease.

5. The Effect of Tele-Rehabilitation on Improving Physical Activity in Patients with Chronic Obstructive Pulmonary Disease: A Systematic Review of Randomized Controlled Clinical Trials

This study presents a systematic review of randomized controlled clinical trials that examine the impact of tele-rehabilitation on improving physical activity in patients with chronic obstructive pulmonary disease (COPD). The researchers conducted a comprehensive analysis of the available studies in this area and found that tele-rehabilitation interventions have the potential to increase physical activity levels in COPD patients. However, the evidence is limited and further high-quality research is needed to confirm these findings. Future studies should focus on investigating the long-term effects of tele-rehabilitation, determining the optimal duration and frequency of tele-rehabilitation sessions, and assessing the feasibility and acceptability of tele-rehabilitation programs in real-world clinical settings. Overall, tele- rehabilitation shows promise as a means to enhance physical activity in COPD patients, but more research is needed to fully understand its effectiveness and potential benefits.

6. Exercise Capacity in Patients with Chronic Obstructive Pulmonary Disease Treated With Tele-Yoga Versus Tele-Pulmonary Rehabilitation: A Pilot Validation Study

This pilot study aimed to compare the effects of tele-yoga and tele-pulmonary rehabilitation on exercise capacity, dyspnea, quality of life, and self-efficacy in patients with COPD. The study included 30 patients who received an 8-week group-based program of supervised exercise training and education, either via tele-yoga or tele-pulmonary rehabilitation. The primary outcome was change in six-minute walk distance (6MWD), and secondary outcomes included dyspnea score, St George's Respiratory Questionnaire (SGRQ), and COPD Self-

Efficacy Scale (CSES). The results showed that both tele-yoga and tele- pulmonary rehabilitation had significant positive effects on 6MWD, dyspnea, SGRQ, and CSES compared to baseline. However, there was no significant difference between the two groups in any of the outcomes.

The reasons of lack of pulmonary telerehabilitation.

1. Barriers and enablers of COPD telerehabilitation – a frontline staff perspective

This study aimed to examine the barriers and enablers of health professionals to online exercise- based TR for patients with COPD. The study used semi-structured interviews with 25 health professionals who had experience with conventional COPD rehabilitation or TR. The interviews were analyzed using the Theoretical Domains Framework, which is a comprehensive model of behavior change. The results showed that six domains were important for understanding the barriers and enablers of TR from a staff perspective: skills, professional role and identity, beliefs about capabilities, beliefs about consequences, environmental context and resources, and social influences. The study suggested that involving the health professionals in the decision process and providing them with sufficient education and skill training were essential for a successful implementation of TR in clinical practice.

2. Knowledge, Attitude, and Barriers to Telerehabilitation-Based Physical Therapy Practice in India

This study aimed to explore the knowledge, attitude, and barriers of PTs towards TR in physical therapy settings in India. TR is a part of telemedicine that provides rehabilitation services to people in remote locations. The study used a 14-item questionnaire that was mailed to 347 PTs who worked in hospitals and rehabilitation centers across 13 provinces. The results showed that more than half of the PTs reported having sufficient knowledge about TR, but only a third reported that their workplaces had installed TR facilities, and only a fifth utilized them. The most common types of TR used were image-based and sensor-based, while virtual reality was less common. The main barriers to implementing TR were technical issues, staff skills, and cost. The study concluded that there was a gap between the knowledge and practice of TR among PTs in India and suggested some strategies to overcome the barriers and promote the use of TR in physical therapy settings.

3. Striving for Confidence and Satisfaction in Everyday Life with Chronic Obstructive Pulmonary Disease: Rationale and Content of the Tele-Rehabilitation Programme

The article describes the rationale and content of a tele-rehabilitation programme for patients with chronic obstructive pulmonary disease (COPD) called COPD-Life. The programme is based on the principles of self-

management, empowerment, and person-centred care, and aims to improve the confidence and satisfaction of patients in their everyday life with COPD. The programme consists of three main components: 1) an individualised exercise plan delivered through a tablet device and a wearable sensor, 2) an online platform that provides educational materials, self-monitoring tools, and peer support, and 3) regular telephone coaching sessions with a nurse. The article explains the theoretical background, the development process, and the expected outcomes of the programme. The authors also present the design of a randomised controlled trial that will evaluate the effectiveness and feasibility of COPD-Life compared to usual care. The article concludes that COPD-Life is a novel and promising intervention that has the potential to enhance the quality of life and well-being of patients with COPD.

4. Adherence and factors affecting satisfaction in long-term telerehabilitation for patients with chronic obstructive pulmonary disease: a mixed methods study.

The article evaluates the adherence and satisfaction of patients with chronic obstructive pulmonary disease (COPD) who participated in a long-term telerehabilitation programme. The programme consisted of daily home-based exercise training, weekly video consultations with a physiotherapist, and self-management education.

5. Supervised pulmonary tele-rehabilitation versus pulmonary rehabilitation in severe COPD: a randomised multicentre trial

The article compares the effects of supervised pulmonary tele-rehabilitation (PTR) versus conventional pulmonary rehabilitation (PR) in patients with severe chronic obstructive pulmonary disease (COPD). PTR is a home-based intervention that uses videoconferencing and web-based platforms to deliver exercise training, education, and counselling by a multidisciplinary team. PR is a centre-based intervention that provides similar components in a group setting. The article reports the results of a randomised multicentre trial that enrolled 150 patients with severe COPD who were allocated to either PTR or PR for 10 weeks. The primary outcome was the change in the 6-minute walk distance (6MWD) from baseline to 10 weeks. The secondary outcomes included health-related quality of life, dyspnoea, anxiety, depression, physical activity, and health care utilisation. The article shows that both PTR and PR improved the 6MWD significantly, but there was no difference between the two groups. The article also shows that both PTR and PR improved the secondary outcomes similarly, except for physical activity, which increased more in the PTR group. The article concludes that PTR is as effective as PR in improving exercise capacity and quality of life in patients with severe COPD,

and that PTR may have some advantages over PR in terms of accessibility, flexibility, and physical activity promotion.

Conclusion

Telerehabilitation is a promising modality for delivering PR to COPD patients who face difficulties in accessing or attending conventional PR programs. Telerehabilitation can provide similar benefits as center-based PR in terms of physical and mental health outcomes, as well as reduce the burden on the health care system. However, more research is needed to address the challenges and gaps in the evidence base of telerehabilitation for COPD patients. Specifically, more high-quality randomized controlled trials are needed to compare different types and intensities of telerehabilitation interventions, as well as to evaluate their cost-effectiveness and long-term effects. Furthermore, more studies are needed to explore the perspectives and preferences of COPD patients and health care providers regarding telerehabilitation, as well as to identify the factors that influence their acceptance and adherence.

Future Direction:

Based on our review, we suggest some future directions for research and practice in the field of telerehabilitation for COPD patients. First, we recommend developing and testing standardized protocols and guidelines for telerehabilitation interventions that are tailored to the needs and characteristics of COPD patients. Second, we suggest using innovative technologies such as wearable devices, mobile applications, virtual reality, and gamification to enhance the engagement and motivation of COPD patients in telerehabilitation programs. Third, we propose conducting multicenter and multinational studies to evaluate the scalability and generalized ability of telerehabilitation interventions across different settings and populations. Fourth, we advocate for establishing collaborative networks and partnerships among stakeholders such as researchers, clinicians, policy makers, industry partners, and patient organizations to facilitate the dissemination and implementation of telerehabilitation interventions for COPD patients.

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