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Recent Physiotherapy Advancement and Future Orientation in Respiratory Care

Dr. Poonam Pachauria[1], Dr. Tahzeeb Fatima[2]

[1, 2]Assistant Professor, Era University, Lucknow, UP, India

Abstract: ***Respiratory physiotherapists have a key role to perform respiratory care modalities that include oxygen therapy, breathing treatments, pulmonary drainage, mechanical ventilation & cardiopulmonary resuscitation. The current narrative review emphasizes the profession's diversity, summarises the recent confirmation and practice and addresses future research orientation in respiratory care. Here, we briefly contour the areas that respiratory physiotherapists can act in the comprehensive care of patients with respiratory conditions. Additionally, we emphasize the areas in which further confirmation require to be gathered to approve the efficacy of respiratory therapy techniques.***

Keywords: Respiratory therapy techniques, airway clearance, advancement, breathing

1. Introduction

Respiratory therapy is a medical profession primarily concerned with assisting lung function of individuals with severe acute or chronic respiratory disease. One of the conditions frequently dealt with is obstruction of breathing passages in which chest physiotherapy is used to facilitate clearing the airway of mucus or liquid secretion by suction. Chest percussion performed manually or by means of a handheld percussor produces vibrations that help to loosen and mobilize secretions. Postural drainage is a technique in which the forces of gravity are used to promote the drainage of obstructing secretions. Aerosol treatments are used to relieve bronchospasms and mucous membrane swelling and to mobilize secretions for easy removal.

In recent years, respiratory physiotherapists have established an important role within the integrated care continuum of patients with respiratory diseases, ranging from chronic outpatient care [for e. g. Exercise training] to critically ill care in the ICU [for e. g. Early mobilisation]. Respiratory physiotherapists are currently closely involved in the multidisciplinary care of patients suffering & recovering from corona virus disease 2019. [1 - 3]Depending on the condition & setting, respiratory physiotherapists will address multiple treatable traits including impairment of mucus evacuation, atelectasis, breathing asynchrony, respiratory & peripheral muscle weakness, deconditioning & physical inactivity. In an attempt to harmonise the training, the European Respiratory Society (ERS) recently developed & published the Harmonised Education in Respiratory Medicine in Respiratory Medicine for European Specialists [HERMES] physiotherapy curriculum, which intends to be freely available core syllabus for postgraduate training in respiratory physiotherapy. [4, 5]The HERMES is an initiative from the ERS physiotherapists group & ERS leadership to standardise core knowledge, skills, attitudes &competencies that physiotherapists require to asses, treat & follow patients with respiratory diseases & cover different aspects of respiratory physiotherapy interventions. [6]

Techniques for airway clearance: Airway clearance techniques refer to a variety of different strategies used to eliminate excess secretions. Their aim is to reduce airway obstruction caused by secretions occupying the airway lumen & so prevent respiratory tract infections, re - expand the collapsed areas of the lung, thus improving gas exchanges and decreasing the inflammatory response. [7 - 10] In healthy lungs, the body is able to remove inhaled particles, including microorganisms, by several mechanisms [for e. g. Mucociliary clearance, cough reflexes & action of alveolar macrophages.] In normal conditions, healthy mucus is a gel with low viscosity and elasticity that is easily drained by ciliary action. In contrast, mucus dysfunction has higher viscosity and elasticity which is more difficult to clear. The conversion from healthy to pathologic mucus occurs through multiple mechanisms that change its properties, including increased mucus production and bronchovascular permeability and infilteration with inflammatory cells. Accumulation of mucus results from secretion overproduction and decreased clearance, promoting inflammation and recurrent respiratory exacerbations. [11 - 13]

Airway clearance techniques aim to improve mucociliary transport to drain secretion effectively in individuals with excess secretions or sputum retention, optimise quality of life and reduce severity and frequency of exacerbations, independently of the disease that has produced the impairment. Depending on the techniques chosen, the effects of airway clearance are based on producing changes in both lung volumes and expiratory flows. It can also include offering intra and extra pulmonary vibrations and compressions of the rib cage. [14] Patients suffering from bronchiectasis may also benefit from airway clearance. Both PEP therapy and manual chest physiotherapy have proven effective. [15] However, studies including long - term follow - up data are very limited and the quality of available studies is, on average, low. [16, 17] In patients with COPD, airway clearance techniques seem to be safe. However studies suggest that the benefits achieved may be small, especially if no pre - selection is made of patients prone to the retention of secretions. [18]

Respiratory muscles assessment: Respiratory muscle weakness leads to respiratory pump failure. Respiratory muscle dysfunction that is reduced strength or endurance is to be distinguished from lung function abnormalities.

Respiratory muscle weakness is frequently present in patients with respiratory symptoms, patients with neuromuscular diseases and patients admitted to the ICU. [19] Lung function assessment including spirometry, assessment of static lung volumes and diffusion capacity. In two systematic reviews, it was observed that inspiratory muscle training in mechanically ventilated patients can improve respiratory muscle function and might facilitate weaning from mechanical ventilation. [20, 21] From the meta - analysis in patients with COPD, it can be concluded that inspiratory muscle training can improve inspiratory muscle strength and endurance, functional exercise capacity, dyspnoea and quality of life. [22, 23]

The current evidence is inconclusive as to who might benefit most from additional respiratory muscle training as part of a comprehensive pulmonary rehabilitation programme. Patients with COPD, inspiratory muscle training in association with exercise training may cause larger decreases in dyspnoea intensity at similar work rates compared to exercise training without the association of inspiratory muscle training. [24]

Breathing strategies: Lung hyperinflation is extremely common in obstructive lung disease patients and occurs over the progression of the disease. [25] A growing body of evidence suggests that dynamic hyperinflation contributes to dyspnoea and activity limitation. [26, 27] Several treatment options are available for the respiratory physiotherapists to assist overburdened respiratory muscles to better cope with increased loads during (exercise) breathing and improve recovery from symptoms during and after periods of physical exertion resulting in dyspnoea. [28 - 31]

Train the patients to transiently breathe slowly and deeply during exercise should decrease hyperinflation, work of breathing and improve symptoms and exercise capacity. [29] Patients with severe airflow obstruction and lung hyperinflation that spontaneously use pursed lip breathing successfully reduce expiratory flow limitation, decrease respiratory rate and therefore experience improvements in dyspnoea at rest and during exercise. [28]

A computerised ventilation feedback intervention to slow the respiratory rate during exercise, combined with an exercise training programme. [32] They showed reduction in respiratory rate, ventilation and dynamic hyperinflation at isotime during a constant load cycling task. These improvements were related to improvements in dyspnoea during exercise. The feasibility and persistence of these positive effects in the absence of feedback still need to be determined to make this approach applicable in clinical practice.

Physical activity and exercise: Exercise intolerance is a hallmark of patients with lung diseases. Exertional dyspnoea and fatigue or combinations of both are reported as factors limiting exercise capacity in this population. Exercise training has long been recognised s a cornerstone of pulmonary rehabilitation programmes. [33] In most countries, respiratory physiotherapists are considered members of the core interdisciplinary team within the framework of pulmonary rehabilitation. [34]

Current recommendations for exercise training prescription include high - intensity endurance exercise from three to five times per week, for atleast 8 weeks and resistance training recommendation of one to three sets of eight to twelve repetitions, two to three days per week, with initial loads of atleast 60% of the one - repetition maximum test. Alternatively, a load that evoked fatigue after eight to twelve repetitions can also be used. [33]Exercise training should combine endurance and strengthening exercises for upper and lower limbs. The programme's endurance component should last atleast 20 minutes per session and can be performed in a continuous or interval method. The most functional muscle groups should be targeted for the strengthening exercises. [33]

Minimum recommended parameters for exercise training and levels of physical activity in daily life [PADL]

S. No.		Exercise Training	PADL
1.	Frequency	3 - 5 times/week	>3 - 5days/week
2.	Intensity	Endurance training >60% of maximum exercise capacity or 0 - 10 Borg scale 4 - 6 Resistance training >60% of one - repetition maximum test or a load that evokes fatigue between 8 & 12 repetitions	>3 MET
3.	Duration	Endurance training >20 - 60 min/session Resistance training: 1 - 3 sets of 8 - 12 repetitions	>150 min/week [or 7000 - 10, 000 steps/week]

Physiotherapy in intensive care unit: Physiotherapists are critical members of the inter - professional ICU team who have expertise in multi - system assessment and management of intubated and spontaneously breathing patients. [35] Traditionally, the mainstay of physiotherapy management was focused on preventing and managing respiratory complications such as atelectasis, sputum retention & facilitation of ventilatory weaning or prevention of reintubation. There is growing evidence to suggest that active mobilisation & rehabilitation may improve muscle strength, functional independence & reduce delirium, particularly if introduced within the first few days of an ICU admission. [36] There is also compelling evidence emerging for IMT to strengthen inspiratory muscles & accelerate weaning in ventilated ICU patients. [37]

A comprehensive systematic review has identified low adverse/safety events associated with mobilisation, with the majority being transient changes in cardiovascular & respiratory systems. [38] Expert recommendations have been developed to guide safety criteria for active mobilisation of mechanically ventilated adult patient considering the differing demands of exercise in and out of bed. [39]

Adult patients in the ICU provide recommendations on managing pain, agitation, delirium, immobility & sleep. These are recognised as a key modifiable factor that may impact the development of muscle weakness & long - term mental, cognitive & physical impairments. [40]

2. Future Research Directions

This work demonstrates the strong contribution of physiotherapists and their specific interventions in the integrated care of patients with respiratory diseases. With the growth of respiratory physiotherapy research and physiotherapist specially training in recent years, a boost in evidence - based practice was seen. Currently, respiratory physiotherapists are more used to support their clinical decision making on their professional practice expertise, the best available evidence and on patient's preferences. As we have shown throughout the different sections, there are several unanswered questions about the effectiveness of interventions that we should pursue in the coming years.

Population: Understand effect of patient phenotype recovery on intervention response. Effect of multi - morbidity & frailty on intervention/outcomes. Further understanding of treatable traits.

Intervention: Well described protocols. Improved blinding strategies. Optimal timing, setting, type, duration & method of delivery.

Comparator: Description of usual care practice. International versus local context to physiotherapy intervention delivery.

Outcomes: Core sets of measures. Long - term data collection to understand effect of interventions.
To do that properly, we should learn from current evidence gaps and conduct studies with high methodological rigor.

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