Respiratory Physiotherapy and respiratory therapies in patients with COVID-19: A systematic review and meta-analysis

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Abstract

Background and aim: Patients with Covid-19 generally develop respiratory problems due to pneumonia, which results in symptoms such as decreased oxygen levels and a risk of pulmonary fibrosis. The purpose of this study was assessment efficacy of Respiratory Physiotherapy and respiratory therapies in patients with COVID-19.

Method: In this systematic review and meta-analysis based on PRISMA guidelines, Respiratory Physiotherapy and respiratory therapies in patients with COVID-19 in all articles in this case were reviewed between January 2019 and March 2022. For this purpose, articles published in international databases and PubMed, Scopus, ScienceDirect, Embase were reviewed and Google Scholar search engine was used. Used PECO strategy to answer the research questions. Data analysis was performed using STATA.V16 software. I^2 index test was used to evaluate the heterogeneity of selected studies.

Result: In the initial search, 171 articles were identified; the full text of 12 articles was reviewed; finally two articles entered the analysis. Mean differences of pO_2 before and after Respiratory Physiotherapy was 17.52 mmHg (MD; 95 CI -19.43 mmHg, -15.62 mmHg).

Conclusion: due to the major respiratory problems of people with Covid-19, respiratory physiotherapy can be considered and used as an important part of treatment and reduction of respiratory problems.

Key words: Respiratory Physiotherapy, respiratory therapies, COVID-19

Introduction

New virus (SARS-CoV-2) is a virus belonging to the class of beta-coronaviruses. This virus is the third known animal virus (after SARS and MERS, both of which belong to the category of beta viruses)(1, 2). The available evidence confirms that SARS-CoV-2 has evolved from bats(3). The ways of transmission of this disease are through droplets, close contact with infected people or objects, aerosols and even talking. People with the latent period of the disease can also transmit the virus to other people(4). Coronavirus is one of the main pathogens that primarily targets the human respiratory system(5). The main pathogenesis of COVID-19 infection is as a targeted virus of the respiratory system, severe pneumonia, RNAaemia, with the occurrence of vitreous opacities and cute heart failure (6). This pneumonia is divided into 4 categories of mild, moderate, severe, and severe criticality(7). In the severe type, there are symptoms such as severe respiratory distress, the number of breaths equal to or more than 30 times per minute, a decrease in the percentage of blood oxygen saturation to less than 90% (8). In the severe type of critical respiratory failure and the need for a ventilator, shock, failure of other organs and other body systems are seen(9). In severe cases of pneumonia, dyspnea usually develops one week after the onset of the disease. These manifest rapidly in the form of acute respiratory distress syndrome, septic shock, and inability to correct metabolic acidosis, coagulation dysfunction(10). Respiratory Physiotherapy Chest physiotherapy or respiratory physiotherapy is a set of methods performed to help clear the airways and increase the function of the respiratory system in connection with one or more respiratory diseases(11). The goals of respiratory physiotherapy are to improve ventilation, increase respiratory muscle function, improve endurance for general activities, prevent the accumulation of pulmonary secretions, improve cough, increase chest mobility, correct breathing pattern, prevent atelectasis, correct or prevent postural deformities. Respiratory physiotherapy has specific principles, methods and techniques and is used according to the patient's condition, which includes one or a combination of the following: Manual techniques including Percussion, Vibration, Shaking, postural evacuation techniques, training and coughing, exercises Respiratory, and suction(12). Due to the fact that coronavirus is one of the most important target tissues of the respiratory system and its complications include shortness of breath, decreased lung volume, decreased oxygen levels (hypoxia), irritative and dry cough, irritation of the throat, sputum, risk of fibrosis Pulmonary and in more severe cases a decrease in the level of consciousness. Respiratory physiotherapy can reduce the stress on the respiratory system and other related organs while improving the respiratory status of patients and reduce the risk of further damage to the tissues of the respiratory system and the problems and discomfort of patients and staff. The treatment department will assist in faster discharge of patients and physical and mental relaxation of staff and maintenance of patient financial resources and medical centers. Accordingly, all patients with coronavirus need physiotherapy intervention(13). The present study investigated Respiratory Physiotherapy and respiratory therapies in patients with COVID-19.

Method

Search strategy

In this systematic review and meta-analysis based on PRISMA guidelines(13), Respiratory Physiotherapy and respiratory therapies in patients with COVID-19 in all articles in this case were reviewed between January 2019 and March 2022. For this purpose, articles published in international databases and PubMed, Scopus, ScienceDirect, Embase were reviewed and Google Scholar search engine was used. Used PECO strategy to answer the research questions (Table1).

The following keywords were used to search:

Coronavirus Disease 2019, COVID-19, SARS-CoV-2, Respiratory Physiotherapy, respiratory therapies, Chest physiotherapy, Physiotherapy Care.

Inclusion criteria

The selection criteria were observational, interventional, clinical trial, cohort and full text availability. For access to more information, the sources of the reviewed articles were also reviewed for access to other articles.

Table1. PECO strategy

PECO strategy	**Description**
P	Population: patients with COVID-19
E	Exposure: Respiratory Physiotherapy and respiratory therapies
C	Comparison: any comparator or no comparator
O	Outcome: clinical outcome

Data Extraction

All final papers entered into the systematic and meta-analysis process were prepared by a pre-prepared checklist. Checklists included article title, first author name, year of publication, sample size, prevalence of clinical signs, and mean age.

Statistical analysis

Data analysis was performed using STATA.V16 software. I^2 index test was used to evaluate the heterogeneity of selected studies (I^2< 50% = low heterogeneity and 50<I^2< 75% = moderate heterogeneity and I^2>75% = high heterogeneity).

Result

In the initial search, 171 articles were identified. After importing all articles into EndNote.X8 software and categorizing the information of all duplicate articles in all databases, articles with irrelevant content, abstracts of articles published in conferences were removed, a total of 98

articles. 73 article entered and examined in second stage. At this stage, while reviewing the titles and abstracts of articles, 61 unrelated articles were excluded from the study. In the third stage, the full text of 12 articles was reviewed. Low quality articles were removed. At this stage, finally two articles that were published between January 2019 and March 2022 and met the inclusion criteria, entered the analysis.

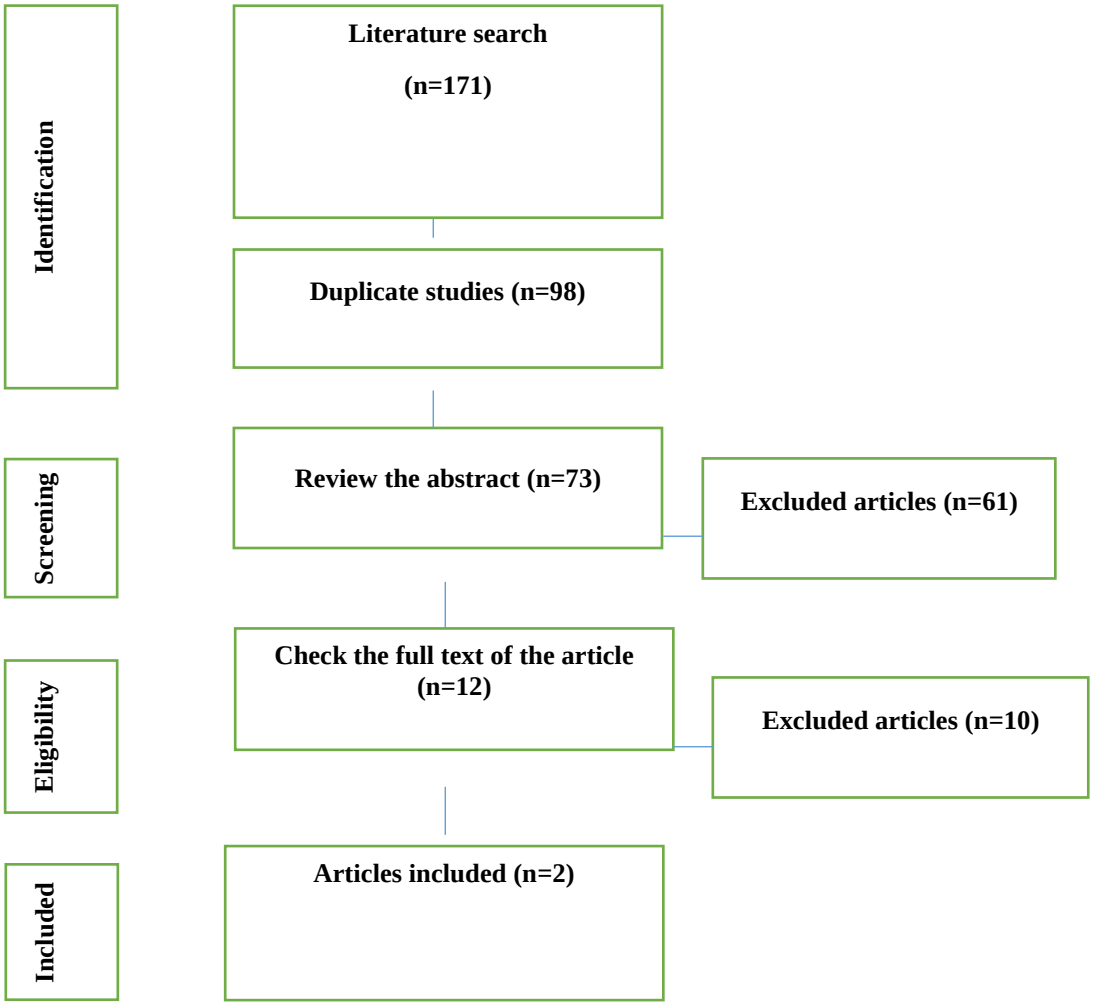

Figure 1. PRISMA flowcharts

Characteristics

One RCT study and one observational study included in present article. The number of patients were 40 and mean age was 60 years (11 female and 29 male), respectively (Table2).

Since only two studies were found to meet the purpose of the study; each study result was reviewed.

Battaglini et al., 2021 (14) evaluated Pre-Post Efficacy of Respiratory Physiotherapy; Based on the findings, pO_2 improved during the study and in comparison before and after Respiratory Physiotherapy (P = 0.042).

Javaherian et al., 2021 (15) evaluated safety and efficacy of Pulmonary physiotherapy; the result showed there was statistically significant different between Pre and Post Pulmonary physiotherapy of mean pO_2.

According to Meta-analysis: mean differences of pO_2 before and after Respiratory Physiotherapy was 17.52 mmHg (MD; 95 CI -19.43 mmHg, -15.62 mmHg). This result showed Respiratory Physiotherapy improved pO_2 in patients with COVID-19.

Table2. Profile of patients in selected studies

Study. Years	Study design	Number of Patients		Age (mean)	ICU discharge characteristics		Ventilation Type
		male	female	(years)	Dead	Alive	
Battaglini et al., 2021 (14)	observational study	16	4	63	1	19	PSV:9 COT:11
Javaherian et al., 2021 (15)	RCT	13	7	55.5	NR	NR	Nasal: 2 Face mask: 4 Partial rebreathing mask: 13 CPAP: 1

RPT: respiratory physiotherapy; PSV: pressure support Ventilation; COT: conventional oxygen therapy; CPAP: Continuous positive airway pressure

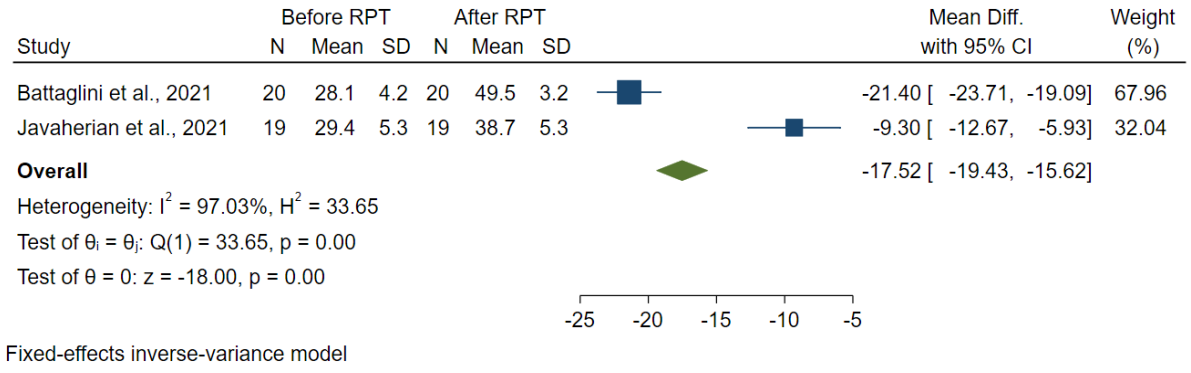

Figure2. Forest plot showed pO2 before and after Respiratory Physiotherapy

Discussion

To perform respiratory muscle exercises and improve respiratory patterns, physiotherapy assistive devices and manual techniques can be used, and respiratory rehabilitation treatment methods based on the patient's tail and exhale muscle strength, along with correcting the

dominant respiratory patterns and increasing lung capacities and volumes. The needs of each patient were designed and changed. Breathing exercises should be done at least twice a day, each time with a long interval between exercises and based on the patient's tolerance. The intensity of breathing exercises should be commensurate with the level of endurance of the respiratory muscles(16, 17). Respiratory retraining includes specific breathing exercises and exercises designed and performed to achieve effective and controlled ventilation, reduce respiratory work, and correct respiratory defects. These exercises fill the alveoli with air as much as possible, cause the muscles to expand, and eliminate anxiety(18). Improper patterns eliminate the activity of the respiratory muscles, reduce the rate of respiration, and reduce the work of breathing. Breathing slowly, regularly and evenly helps to relieve anxiety caused by shortness of breath. These exercises help the client to make the most of the existing respiratory function. Exercises that increase ventilation, chest movement, coordination of respiratory movements, and correction of breathing pattern include diaphragmatic breathing, localized dilation of the lungs, and lip-bud breathing(19). Breathing exercises in various cases such as: abdominal and thoracic surgeries, atelectasis, COPD, obesity, limitations in lung volume such as chest deformities, lung injuries and pleural lesions, neuromuscular disorders such as Guillain-Barre syndrome, patients receiving high doses of sedatives Or use drugs and patients who are connected to a mechanical ventilator are used(20).

In patients with Covid-19, whose lung volume and respiration are reduced, it is important to perform exercises that increase chest volume(21). These exercises can be used lying down or sitting and standing and as progressive exercises based on the ability and needs of patients(22).

The following are some of these exercises:

Exercise 1: The patient sits on a chair and puts his hand to the front, when inhaling (from the nose) (opens the arms and moves them back and forth when exhaling) from the mouth and in the form of puffy lips (hands The exhalation time should be longer than the tail and the air should be blown out of the lungs.

Exercise 2: The patient sits in a chair and puts her hand on her shoulders, when inhaling (from the nose (back to the hand and when exhaling) from the mouth and in the form of a bud lip (brings the hand forward).

Exercise 3: The patient sits on a chair and puts his hand behind his head, when inhaling (from the nose) (brings the hand backwards and when exhaling) from the mouth and in the form of a bud lip (bringing the hand forward).

Exercise 4: The patient sits on a chair and puts his hand in front of his body in the air, away from the nose when he inhales (moves his hand backwards) (and when he exhales) from the mouth and in the form of a pouty lip. Brings forward (close together).

Exercise 5: The patient is standing and crosses his arms in front of his torso. When the tail is opened, the hand is separated from the trunk (and when exhaled) it is brought from the mouth and in the form of a bud lip (the hand is brought forward and in the middle) close to each other.

Effectiveness of interventions: Selective and effective respiratory interventions, while reducing patients' fatigue, causes less necessary energy for exercises and necessary treatment points for the patient in a shorter time, and also prevents the disruption of the respiratory rhythm of patients. Therefore, only interventions and exercises related to each patient should be done specifically for her and unnecessary things should be avoided.

Safety of interventions: This includes the safety of the physiotherapist himself from being infected with the disease and the patient's safety during the interventions so as not to aggravate his condition, either in terms of further infection or in terms of not worsening his respiratory condition due to physiotherapy. To do this, the physiotherapist must use a suitable mask and gloves, goggles, face shield, waterproof gauze, and pay attention to contact precautions (touching eyes, nose, and mouth with contaminated hands) and when working with the patient, Perform respiratory physiotherapy according to the condition and treatment needs and problems so that the physiotherapy itself does not endanger the patient's life.

Very few RCT studies have been performed on the effectiveness of respiratory physiotherapy, and this has prevented the present study from providing strong evidence in this regard; however, meta-analysis showed that pO_2 improved significantly after respiratory physiotherapy. It is recommended that more RCT studies be performed.

Shukla et al.,2020 reported Diaphragmatic breathing exercise increases breath holding time efficiently(19). Liu et al.,2020 in a RCT study reported Six-week respiratory rehabilitation can improve respiratory function(22). Bressi et al., 2021 in a Letter to the editor reported highest level of evidence to assess the efficacy of respiratory rehabilitation in patients with COVID-19(23). These results are in line with the present study, which were excluded from present study due to inclusion criteria.

Conclusion

In present study tried to investigate the role of respiratory physiotherapy and related cases in treatment of patients with Covid-19 based on the available evidence. In general, it was concluded that due to the major respiratory problems of people with Covid-19, respiratory physiotherapy can be considered and used as an important part of treatment and reduction of respiratory problems.

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