

## Effect of Chest Physiotherapy Sessions in Post COVID-19 Patients.

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### Abstract

In recent few years World has been facing a catastrophe known as COVID 19 a hazardous respiratory and multi-systemic disease claiming millions of deaths all around the Globe and the count is still increasing.

Chest physiotherapy technique is based on the theory that when several areas of the chest and back are percussed, shock waves are conducted through the chest wall, slackening the airway secretions. The present study was undertaken to see effects of physiotherapy sessions on pulmonary functions of post COVID patients.

In this hospital based cross sectional study a sum of 51 patients were observed for the outcomes. Patients coming to the institute with sign and symptoms of COVID in second wave from March 2021 to September 2021 with RTPCR positive report and having CT involvement more than 60% (CT score 15) were assigned. Patients with a negative report by 15 days were selected for present study after written and informed consent. These selected patients were undergone physiotherapy sessions and pulmonary function testings as per study protocol.

Considering the results of spirometry except FEV1 rest other parameters like FVC, FEV1/FVC, FEF<sub>25-75%</sub> and PEFR were not significant even after 15 days of extensive physiotherapy. These results were suggestive of positive effects of chest physiotherapy training on post COVID patients after a minimum of 30 days training.

Conclusion - Hence from the present study this can be concluded that physiotherapy helps in improving the pulmonary function tests in post COVID patients at least after a 30 days of training session.

**Keywords:** Chest Physiotherapy, COVID, Pulmonary function test

### Introduction

In recent few years World has been facing a catastrophe known as COVID 19 a hazardous respiratory and multi-systemic disease claiming millions of deaths all around the Globe and the count is still increasing.<sup>1</sup> Such many hazards to mankind can be attributed to respiratory illnesses weather a flu outbreak in 1903 or multiple drug resistant TB or COVID in 2019 governing the world of illnesses over several generations.<sup>2</sup>

This diseases goes in hands with respiratory illnesses like COPD and asthma compounding to be one of the most leading cause deaths.<sup>3</sup>

For controlling these sickness early detection, treatment, follow up and most importantly avoidance of secondary complication should be the target goal. For diagnosing respiratory diseases Pulmonary function tests along with clinical presentations should be of utmost priority, as performing bed side pulmonary function tests can clarify the picture of ongoing disease which will help in early intervention and cessation of complications benefiting patient towards normal day to day disease free life.<sup>4,5</sup>

Chest physical therapy/ Chest physiotherapy is a technique of clearing the airway of surplus mucus. It is based on the theory that when several areas of the chest and back are percussed, shock waves are conducted through the chest wall, slackening the airway secretions. If the patient is positioned suitably, the loosened secretions will then sewer into the upper airways, where they can then be vacated using coughing and deep breathing techniques.<sup>6</sup>

For preserving the respiratory functions airways should be made clear which is carried out in healthy individual by two mechanisms the mucociliary clearance system (MCS) and the capability to cough. If secretions continues to ooze then it becomes difficult task and may lead to a vicious cycle of recurrent episodes of inflammation, respiratory contaminations and perhaps airway obstruction. Chest physical therapy may help to decrease the jeopardies of an ineffective clearance of airway secretions.<sup>7</sup>

Depending on the specific technique and health situation, chest physical therapy may be used on patients in post COVID phase to hasten the recovery.<sup>8</sup>

Various methods of chest physical therapy have been used since the early 1900s and techniques have been advanced since then.<sup>9</sup>

The procedure may be performed by a respiratory therapist, a nurse, or a trained family member which may be easily used in post COVID patients effectively for a speedy recovery.<sup>10</sup> Hence the present study was undertaken to see effects of physiotherapy sessions on pulmonary function test of post COVID patients.

### **Materials and Methods:**

In this hospital based cross sectional study was conducted in a tertiary care government hospital of Bhopal city which was having a COVID dedicated setup. Total of 67 patients were primarily registered for the study of which 16 were dropouts leaving a sum of 51 patients to be observed for the results. Patients coming to the institute with sign and symptoms of COVID in second wave from March 2021 to September 2021 with RTPCR positive report and having CT involvement more than 60% (CT score 15) were assigned. After completion of treatment as per laid guidelines another RTPCR report was done after 15days of admission to the hospital. Patients having a negative report by 15 days were selected for present study after written and informed consent.

Patients coming to hospital were primarily taken to an isolated area in OPD for taking their history and general examination. Procedure for performing spirometry was demonstrated to the patients and the procedure was performed as per ATS/ERS (American thoracic society /European thoracic society) guidelines.<sup>5,11</sup>

While performing spirometry Forced Expiratory Volume at end of 1second (FEV1), forced vital capacity (FVC), FEV1/FVC ratio, FEF<sub>25-75%</sub> and peak expiratory flow rate (PEFR) parameters were recorded. Before starting the first physiotherapy session Pulmonary function testing of the patients was done on day one. Sequential physiotherapy sessions were given to the patients daily for at least 30 days before performing the second spirometry on day 15<sup>th</sup> and third spirometry on 30<sup>th</sup> day of the physiotherapy session to observe the essential changes in the lung. Before performing PFT session rapid antigen test was performed on day 15<sup>th</sup> and 30<sup>th</sup> to avoid COVID positive cases for PFT.

Obtained data was analyzed by using Microsoft office 2013 and graph pad 11. For getting statistically significant results analysis of variance (ANOVA) with Bonferroni's post hoc test was applied.

After performing the Pulmonary function test session of physiotherapy was performed with standard AARC (American Association Respiratory Care) guidelines. Basic principal of Chest physiotherapy was to improve grades of respiratory efforts in post COVID patients in terms of improvement of respiratory compliance, reinforce respiratory muscles, and eradicate exudations from alveolar system. Chest physical therapy comprises postural drainage, chest percussion, and vibration, turning, unrestricted breathing workouts, coughing and positive expiratory pressure (PEP).<sup>12,13</sup>

#### **Turning**

Turning from side to side permits lung expansion. The patient may turn on his or her own, or be turned by a caregiver. Turning should be done at a minimum of every two hours if the patient is bedridden. The head of the bed can also be elevated in order to promote drainage.

#### **Coughing**

Coughing helps to break up secretions in the lungs so that the mucus can be expectorated or suctioned out if necessary. Patients sit upright and inhale deeply through the nose. They then exhale in short puffs or coughs. This procedure is repeated several times a day.

#### **Deep breathing**

Deep breathing helps expand the lungs and forces an improved distribution of the air into all sections of the lungs. The patient either sits in a chair or sits upright in bed and inhales then pushes the abdomen out to force maximum amounts of air into the lung. The abdomen is then contracted, and the patient exhales. Deep breathing exercises are done several times each day for short periods.

Because of the mind-body awareness required to perform coughing and deep breathing exercises, they are unsuitable for most patient under the age of eight.

#### **Postural drainage**

Postural drainage uses the force of gravity to assist in effectively draining secretions from the smaller airways into the central airway where they can either be coughed up or suctioned out. The patient is placed in a head- or chest-down position and is kept in this position for up to 15 minutes. To obtain the head-down positions, the use

of a pillow, beanbag chair, or couch cushions can be helpful. Often, percussion and vibration are performed in conjunction with postural drainage.

#### Percussion

Percussion involves rhythmically striking the chest wall with cupped hands. It is also called cupping or clapping. The purpose of percussion is to break up thick secretions in the lungs so they can more easily be removed. Percussion is performed on each lung segment for one to two minutes at a time. The percussor is moved over one lobe of the lung for approximately five minutes, while the patient is encouraged to performing coughing and deep breathing techniques. This process is repeated until each segment of the lung is percussed.

#### Vibration

As with percussion, the purpose of vibration is to help break up lung secretions. Vibration can be either mechanical or manual. It is performed as the patient breathes deeply. When done manually, the person performing the vibration places his or her hands against the patient's chest and creates vibrations by quickly contracting and relaxing arm and shoulder muscles while the patient exhales. The procedure is repeated several times each day for about five exhalations.

#### Positive expiratory pressure (PEP)

PEP therapy has been extensively tested and is equivalent to standard chest physical therapy. It is an airway clearance method that is administered by applying a mechanical pressure device to the mouth. By breathing out with a moderate force through the resistance of the device, a positive pressure is created in the airways that helps to keep them open. This positive pressure permits airflow to reach beneath the areas of mucus obstruction and to move the mucus toward the larger airways where it can be expectorated.

#### Flutter

The flutter valve is a hand-held mucus clearance device designed to combine positive expiratory pressure (PEP) with high frequency airway oscillations. The device looks like a pipe containing an inner cone that cradles a steel ball sealed with a perforated cover. Exhalation through the device results in a vibration of the airway walls, which in turn loosens secretions.

A patient is considered to have responded positively to chest physical therapy if some, but not necessarily all, of the following changes occur:

- increased volume of sputum secretions
- Changes in breath sounds
- Improved chest x ray
- Increased oxygenation of the blood as measured by arterial blood gas sampling
- The patient's report of increased ease in breathing

#### Precautions

Chest physical therapy should not be performed on those patient with the following:

- Bleeding in the lungs
- Head or neck injuries
- Fractured ribs
- Collapsed lungs
- Acute asthma
- Pulmonary embolism
- Active hemorrhage
- Spinal injuries
- Open wounds or burns

#### Results:

In this hospital based study spirometry results for day 1, 15 and 30 were observed for a sample size of 51 patients. Considering spirometry FEV1, FVC, FEV1/FVC, FEF<sub>25-75</sub> and PEF were recorded. All the subjects under consideration were heights and weight matched. Details of demographic data of the patients is depicted in table 1 as follows:

**Table 1: Demographic values of patients.**

|                     | (Mean± SD)   |
|---------------------|--------------|
| Age (Years)         | 45.36 ± 5.46 |
| Height (centimetre) | 161.6 ± 5.87 |
| Weight (kilogram)   | 57.48± 8.58  |

Details of spirometry values are depicted in table 2 as follows:

**Table 2: Details of spirometry value**

|            | Day 1        | Day 15       | Day 30      |
|------------|--------------|--------------|-------------|
| FEV1       | 1.41 ± 0.33  | 2.13 ± 0.67  | 2.43 ± 0.34 |
| FVC        | 2.09 ± 0.5   | 2.39 ± 0.64  | 2.84 ± 0.37 |
| FEV1/FVC   | 59.16 ± 7.45 | 66.09 ± 7.07 | 78.89 ± 8.9 |
| FEF 25-75% | 0.86 ± 0.54  | 1.09 ± 0.68  | 2.16 ± 0.43 |
| PEFR       | 3.89 ± 1.36  | 5.16 ± 1.12  | 6.8 ± 0.73  |

For getting statistically significant results analysis of variance (ANOVA) test was applied with Bonferroni's post hoc test to see the intergroup relationship whose results are depicted in table 3 as follows:

**Table 3: Results on ANNOVA and Bonferroni's Multiple Comparison post hoc test.**

|            | Day 30 vs Day 15 | Day 30 vs Day 1 | Day 15 vs Day1 |
|------------|------------------|-----------------|----------------|
| FEV1       | NS               | p < 0.05 S      | p < 0.05 S     |
| FVC        | p < 0.05 S       | p < 0.05 S      | NS             |
| FEV1/FVC   | p < 0.05 S       | p < 0.05 S      | NS             |
| FEF 25-75% | p < 0.05 S       | p < 0.05 S      | NS             |
| PEFR       | p < 0.05 S       | p < 0.05 S      | NS             |

Considering the results of spirometry except FEV1 rest other parameters like FVC, FEV1/FVC, FEF<sub>25-75%</sub> and PEFR were not significant even after 15 days of extensive physiotherapy. On the other hand spirometry parameters exposed statistically significant relationship between day 1 and day 30 readings. These results were suggestive of positive effects of chest physiotherapy training on post COVID patients after a minimum of 30 days training.

#### Discussion:

Considering post COVID havoc on the physical and mental status; exercising lungs and ribcage stands out to be the final pathway towards maintaining normalcy of respiratory system. Exercise helps in maintaining cardiopulmonary, metabolic, neurocognitive dynamics also it has pervasive effects on endothelial functions and inflammatory markers. Observations of present study with improvement in pulmonary function test goes in accordance with Jindani M. This observed change in PFT could be due to removal of excess mucus probably positively affecting recovery of the inflamed alveoli.<sup>14</sup>

Physiotherapy helps in rejuvenation and recovery of damaged endothelium by accumulative effect on number of moving endothelial progenitor cells, which would be favorable in COVID-19, facilitated endothelial apoptosis and endothelial cell membrane distraction which will help in improvement of FEF<sub>25-75%</sub> parameter depicting recovery in smaller airways. These findings goes in accordance with Da Silveria.<sup>15</sup>

Physiotherapy modifies the immune reaction. This diminishes invasion of inflammatory cells and hence the risk of lung mutilation by dipping levels of inflammatory markers and cytokine. Which probably will show effects on overall improvement of the lung status as can be correlated with improved levels of FEV1/FVC in present study. These findings are in accordance with Nimen DC.<sup>16</sup>

Considering short term effect of physiotherapy on lungs spirometry did not depict significant changes even after 15days of physiotherapy hence other techniques like body plethysmography or diffusion lung capacity by carbon monoxide may be used to pick up early changes pulmonary function testing as suggested by Gupta YS.<sup>17</sup>

#### Conclusion:

Hence from the present study this can be concluded that physiotherapy helps in improving the pulmonary function tests in post COVID patients at least after a 30 days of training session. The present study could be a stepping stone towards further studies on a larger scales to validate the effects of physiotherapy on lung functions in different setups which could finally be involved in COVID 19 treatment protocol benefiting mankind on an International platform.

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