



## RESEARCH ARTICLE

### EVALUATING THE EFFECT OF CHEST PHYSIOTHERAPY ON CARDIOPULMONARY PARAMETERS IN HOSPITALIZED COVID-19 PATIENTS

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#### ABSTRACT

**Background:** Coronavirus disease 2019 (COVID-19), caused by SARS-CoV-2, primarily affects the respiratory system, leading to hypoxemia, dyspnea, reduced exercise tolerance, and increased oxygen dependency. Chest physiotherapy has been recommended as an adjunct intervention; however, clinical evidence in hospitalized COVID-19 patients remains limited. **Objective:** To evaluate the effect of structured chest physiotherapy on cardiopulmonary signs and symptoms in hospitalized COVID-19 patients. **Methods:** A pre-post interventional study was conducted on 41 COVID-19-positive patients (35–80 years) recruited through convenience sampling from a tertiary care hospital in Bhopal, India. Baseline and Day 14 assessments included heart rate (HR), respiratory rate (RR), peripheral oxygen saturation (SpO<sub>2</sub>), oxygen supplementation requirement, cough characteristics, dyspnea (assessed using the American Thoracic Society dyspnea scale), and functional capacity measured by the 1-minute sit-to-stand (1STS) test. Patients received twice-daily, symptom-oriented chest physiotherapy sessions for 14 days. Data were analyzed using the Wilcoxon signed-rank test ( $p < 0.05$ ). **Results:** Significant improvements were observed in respiratory rate ( $p < 0.001$ ), SpO<sub>2</sub> ( $p < 0.001$ ), cough severity ( $p < 0.001$ ), oxygen supplementation requirement ( $p < 0.001$ ), dyspnea scores ( $p < 0.001$ ), and 1STS repetitions ( $p < 0.001$ ). No statistically significant change was found in heart rate ( $p = 0.716$ ). **Conclusion:** Structured chest physiotherapy significantly improves respiratory parameters, reduces oxygen dependency, and enhances functional capacity in hospitalized COVID-19 patients. These findings support the integration of physiotherapy into multidisciplinary COVID-19 management protocols.

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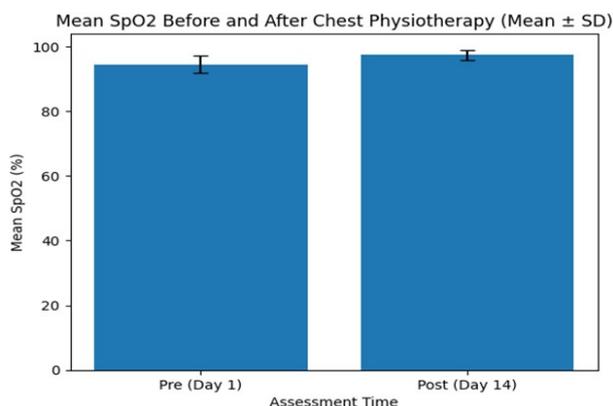
## INTRODUCTION

Coronavirus disease 2019 (COVID-19), caused by SARS-CoV-2, emerged in late 2019 and rapidly progressed into a global pandemic declared by the World Health Organization in March 2020. The disease primarily affects the respiratory system and may range from mild symptoms to severe pneumonia and respiratory failure<sup>13</sup>. Hospitalized patients frequently present with hypoxemia, dyspnea, tachypnea, and reduced functional capacity<sup>1</sup>. Dyspnea is defined by the American Thoracic Society as a subjective experience of breathing discomfort with varying intensity<sup>5</sup>. Persistent respiratory symptoms and physical deconditioning are common during hospitalization and after acute illness<sup>12</sup>. Functional capacity assessment is essential in these patients, and the 1-minute sit-to-stand test (1STS) has been validated as a reliable and practical tool for evaluating exercise tolerance in respiratory populations<sup>6,7</sup>. Current clinical practice recommendations support early respiratory physiotherapy and

mobilization in hospitalized COVID-19 patients to improve ventilation, secretion clearance, and overall recovery<sup>2,8,9,10</sup>. Clinical experiences have demonstrated that structured physiotherapy interventions may enhance oxygenation, reduce complications, and facilitate functional improvement<sup>3,4</sup>. Pulmonary rehabilitation principles further support the integration of breathing exercises and mobilization strategies in respiratory disease management<sup>15</sup>. Despite these recommendations, limited interventional evidence exists evaluating structured chest physiotherapy protocols in hospitalized COVID-19 patients. Therefore, this study aimed to investigate the effect of chest physiotherapy on cardiopulmonary parameters and functional performance in this population.

## NEED OF THE STUDY

COVID-19, caused by SARS-CoV-2, significantly impairs respiratory function, leading to dyspnea, hypoxemia, and



**Graph 1. Comparing mean SpO<sub>2</sub> values before and after chest physiotherapy**

reduced functional capacity. While medical management addresses the infection, evidence regarding the effectiveness of structured chest physiotherapy in hospitalized COVID-19 patients remains limited. Generating clinical data on its impact on cardiopulmonary parameters is essential to support evidence-based rehabilitation practices.

## AIM AND OBJECTIVE

This study aimed to evaluate the effect of structured chest physiotherapy on cardiopulmonary signs and symptoms in hospitalized COVID-19 patients. Specifically, it sought to assess changes in respiratory rate, peripheral oxygen saturation (SpO<sub>2</sub>), oxygen supplementation requirements, dyspnea severity (using the American Thoracic Society dyspnea scale), cough characteristics, heart rate, and functional capacity measured by the 1-minute sit-to-stand test before and after 14 days of intervention.

## RESEARCH HYPOTHESES

**Null Hypothesis (H<sub>0</sub>):** There is no statistically significant difference in cardiopulmonary parameters (respiratory rate, peripheral oxygen saturation, oxygen supplementation requirement, cough severity, dyspnea score, heart rate, and 1-minute sit-to-stand performance) between baseline (Day 1) and after 14 days of chest physiotherapy in hospitalized COVID-19 patients.

**Alternative Hypothesis (H<sub>1</sub>):** Chest physiotherapy produces a statistically significant improvement in cardiopulmonary parameters (respiratory rate, peripheral oxygen saturation, oxygen supplementation requirement, cough severity, dyspnea score, and 1-minute sit-to-stand performance) between baseline (Day 1) and after 14 days of intervention in hospitalized COVID-19 patients.

## METHODOLOGY

**Ethical Clearance:** Ethical clearance was obtained from the Institutional Ethics Committee prior to commencement of the study.

**Informed Consent:** A written informed consent was obtained from all participants before enrolment.

**Study Design:** Pre–post experimental interventional study.

**Study Setting:** Chirayu Paramedical College & Hospital, Bhopal, India.

**Participants:** Forty-one hospitalized COVID-19–positive patients aged 35–80 years were recruited using convenience sampling.

**Study Duration:** The study was conducted over a period of 6 months. Each participant received chest physiotherapy for 14 consecutive days or until hospital discharge, whichever occurred earlier.

**Sampling Technique:** A non-probability convenience sampling method was used to recruit 41 hospitalized COVID-19–positive patients who met the inclusion criteria and were referred for physiotherapy during the study period.

## Inclusion Criteria

- Confirmed COVID-19 diagnosis
- Age 35–80 years
- Hemodynamically stable
- Alert and oriented

## Exclusion Criteria

- Post-COVID recovery phase
- Recent fractures
- Neurological or psychiatric disorders
- Hemodynamic instability

## Outcome Measures

Assessments were performed on Day 1 and Day 14.

## Primary Outcomes

- Respiratory rate (RR)
- Peripheral oxygen saturation (SpO<sub>2</sub>)
- Oxygen supplementation requirement
- ATS dyspnea score

## Secondary Outcomes

- Heart rate (HR)
- Cough characteristics
- 1-minute sit-to-stand test (1STS)

**Study Procedure:** After obtaining informed consent, baseline assessments were performed on Day 1, including measurement of heart rate, respiratory rate, peripheral oxygen saturation (SpO<sub>2</sub>), oxygen supplementation requirements, cough characteristics, dyspnea severity (using the American Thoracic Society dyspnea scale), and functional capacity using the 1-minute sit-to-stand (1STS) test. Following the initial evaluation, participants received structured, symptom-oriented chest physiotherapy twice daily (7 days per week). The intervention included breathing exercises, airway clearance techniques, positioning strategies (including prone positioning where indicated), limb mobilization, and functional exercises. Vital parameters were monitored before and after each session to ensure patient safety. Final assessments were conducted on Day 14 or at discharge using the same outcome measures to evaluate changes following the intervention.

**Table 1. Comparison of Pre- and Post-Intervention Cardiopulmonary Parameters Following 14 Days of Chest Physiotherapy (Mean ± SD)**

Variable	Pre (Mean ± SD)	Post (Mean ± SD)	p-value	Interpretation
HR	83.04 ± 13.81	83.21 ± 10.64	0.716	Not significant
RR	21.63 ± 5.41	17.65 ± 3.95	<0.001	Significant
SpO <sub>2</sub>	94.53 ± 2.65	97.46 ± 1.53	<0.001	Significant
Cough	0.87 ± 0.33	0.21 ± 0.41	<0.001	Significant
O <sub>2</sub> Support	0.60 ± 0.49	0.19 ± 0.40	<0.001	Significant
ATS Score	2.07 ± 1.48	0.73 ± 0.94	<0.001	Significant
1STS	11.92 ± 6.70	17.12 ± 7.68	<0.001	Significant

**Intervention Protocol:** Patients received twice-daily chest physiotherapy sessions for 14 days, including:

- Diaphragmatic breathing
- Segmental expansion exercises
- Pursed-lip breathing
- Chest proprioceptive neuromuscular facilitation techniques
- Active Cycle of Breathing Technique (ACBT)
- Dyspnea-relieving positioning
- Prone positioning (where indicated)
- Limb mobilization exercises
- Functional mobilization training

Interventions were symptom-specific and individualized.

**STATISTICAL ANALYSIS:** Data were analyzed using SPSS version 25. Since data were non-normally distributed and paired, the Wilcoxon signed-rank test was applied. Statistical significance was set at  $p < 0.05$ .

## RESULTS

Forty-one patients completed the study. Significant improvements were observed between baseline and Day 14:

## DISCUSSION

The present study demonstrated significant improvements in respiratory rate, peripheral oxygen saturation (SpO<sub>2</sub>), dyspnea scores, cough characteristics, oxygen supplementation requirements, and functional capacity after 14 days of structured chest physiotherapy. No significant change was observed in heart rate. These findings are consistent with Righetti et al.<sup>3</sup>, who reported beneficial effects of physiotherapy interventions on respiratory function and clinical stability in COVID-19 patients. Thomas et al.<sup>2</sup> provided clinical recommendations supporting early respiratory physiotherapy in acute hospital settings, emphasizing airway clearance techniques, breathing exercises, and early mobilization. Similarly, Spruit et al.<sup>8</sup> highlighted the importance of early rehabilitation to counteract deconditioning and improve recovery outcomes. Battaglini et al.<sup>4</sup> demonstrated that chest physiotherapy improved respiratory mechanics and supported ventilator weaning in critically ill COVID-19 patients. Although our study primarily involved non-ventilated individuals, similar improvements in oxygenation and reduced oxygen dependency were observed. Position papers and rehabilitation guidelines have also endorsed respiratory physiotherapy as an adjunctive treatment in acute COVID-19 management<sup>9-10</sup>. The significant improvement in 1STS performance observed in this study aligns with previous literature validating its utility in pulmonary rehabilitation and post-COVID recovery<sup>6-7,12</sup>. Increased repetitions indicate enhanced exercise tolerance and

cardiopulmonary efficiency. These improvements are supported by established pulmonary rehabilitation concepts described by international respiratory societies<sup>15</sup>. In contrast, earlier research by Graham et al.<sup>14</sup> in bacterial pneumonia reported no additional benefit of chest physiotherapy in accelerating clinical resolution. The divergence from our findings may be attributed to differences in disease etiology, modern physiotherapy techniques, individualized treatment approaches, and early mobilization strategies used in contemporary COVID-19 care. Overall, the present findings reinforce existing evidence supporting structured, symptom-oriented chest physiotherapy in hospitalized COVID-19 patients<sup>2,3,4,8,15</sup>. However, the absence of a control group and the relatively small sample size limit causal inference. Further randomized controlled trials with larger samples are recommended to confirm these results.

## LIMITATIONS

- Small sample size (n = 41)
- Single-center study
- Lack of control group
- Convenience sampling method
- No long-term follow-up

## FUTURE RESEARCH

- Multicenter randomized controlled trials
- Larger sample sizes
- Long-term follow-up studies
- Subgroup analysis based on disease severity
- Comparative evaluation of individual physiotherapy components

## CONCLUSION

Structured chest physiotherapy significantly improves respiratory rate, oxygen saturation, dyspnea, cough severity, oxygen dependency, and functional capacity in hospitalized COVID-19 patients. Heart rate remained unchanged. These findings support the integration of chest physiotherapy into comprehensive COVID-19 management protocols.

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**Conflict of Interest:** The authors declare that there is no conflict of interest.

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