

## Chest therapy and breathing exercise in COVID-19 patient: a case report



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### ABSTRACT

**Background:** The coronavirus disease (COVID-19) pandemic has several clinical manifestations from asymptomatic to critical condition. Shortness of breath is one of the hallmark symptoms of COVID-19 infection. The main medical management for shortness of breath in COVID-19 infection is oxygen therapy. Physiotherapy and medical rehabilitation such as breathing exercise and chest physiotherapy can be adjuvant therapy that effectively improves breathing effort in COVID-19 patients. This case report will describe breathing exercises and chest therapy done in a patient with a COVID-19 infection.

**Case:** In this study, we presented the case of a 53-year-old female patient with complaints of fever, cough, fatigue, anosmia, shortness of breath, and diagnosis with confirmed COVID-19 infection based on swab PCR result. On admission in the isolation ward, the patient was on non-invasive ventilation (NIV), medical medication, and physical therapy. The physical therapy done in this patient was breathing exercise and chest therapy once daily. After four series of chest therapy and breathing exercise, the shortness of breath and her breathing effort was improved. The patient was discharged after 15 days of hospitalization.

**Conclusion:** This case shows the utility of chest therapy and breathing exercise as a physical rehabilitation treatment for the COVID-19 patient. This physical therapy helps to maximize lung expansion and improve the patient's breathing effort.

**Keywords:** breathing exercise, chest therapy, COVID-19 infection, physical rehabilitation.

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## INTRODUCTION

The coronavirus disease (COVID-19) pandemic has been spreading throughout the world since first discovered in Wuhan, Hubei province China in December 2019.<sup>1</sup> As March 2021, the COVID-19 cases had reached 133 million cases all over the world, with 2.89 million cases of death.<sup>2</sup> The clinical manifestation of COVID-19 infection has a various range from asymptomatic until severe or critical manifestation.<sup>1</sup> Shortness of breath is one of the COVID-19 hallmark symptoms that can escalate quickly into a critical condition such as acute respiratory distress syndrome. Shortness of breath in COVID-19 infection happened due to difficulty on oxygen diffusion perfusion in the lungs.<sup>3,4</sup>

The patient with COVID-19 infection has a fast but shallow breathing pattern or tachypnea. It happened due to the inflammation process caused by SARS-CoV-2 viruses that disturb the lung's oxygen diffusion and perfusion process.

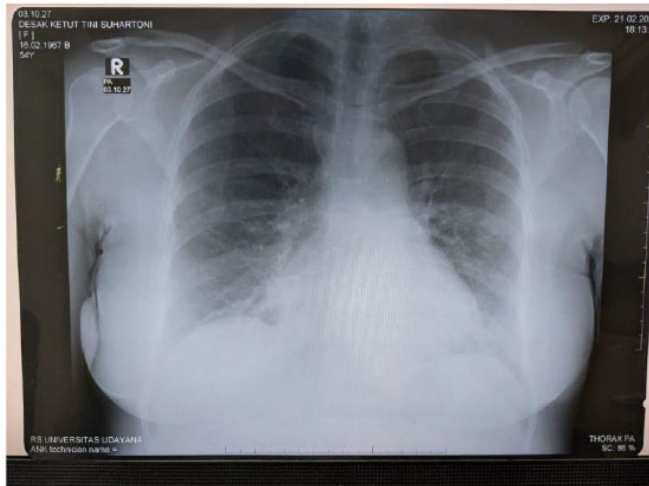
The clinical manifestation of respiratory failure is increasing breathing effort marked by tachypnea and the usage of auxiliary respiratory muscle, retraction, and paradoxical breathing pattern.<sup>3,4</sup> The main medical management to overcome the shortness of breath in COVID-19 infection is by oxygen therapy according to the degree of clinical manifestation, which can be by non-invasive ventilation or invasive ventilation by a ventilator.<sup>5</sup> Other than that, physiotherapy has proven effective for improving breathlessness and the patient's breathing effort. Physical therapy that can be applied in COVID-19 patients is breathing exercise and chest therapy. Breathing exercise helps to make a full chest expansion and lung recoil that increases the lung's vital capacity and resolves shortness of breath. Chest physiotherapy has been used in many different respiratory conditions, including COVID-19 infection. Chest physiotherapy effectively helps sputum expectoration, improves the respiratory system's efficiency,

increases chest expansion, strengthens the respiratory muscles, and decreases sputum accumulation in airways.<sup>6,7</sup>

Several studies have shown the benefit of physiotherapy for COVID-19 patient, but they're also some recommendation for physiotherapy use regarding the virus transmission.<sup>8</sup> This case report will describe a case of a COVID-19 patient with shortness of breath that improved by serial breathing exercise and chest physiotherapy.

## CASE PRESENTATION

We reported a case of a 53-year-old female patient with complaints of fever, cough, fatigue, and anosmia four days before the admission to Udayana General Hospital, Bali, Indonesia. The patient was diagnosed with a confirmed COVID-19 infection based on the swab PCR result and admitted to the isolation ward. The patient doesn't have any past medical history or allergic to the medication. The chest x-ray examination revealed pneumonia



**Figure 1.** The patient’s chest x-ray results showed consolidation on both basal parts of the lung tends to be pneumonia and cardiomegaly.

**Table 1.** Patient’s laboratory results

| Parameter                        | Result | Parameter                        | Result          |
|----------------------------------|--------|----------------------------------|-----------------|
| WBC (10 <sup>3</sup> /μL)        | 5.78   | HCT (%)                          | 41.6            |
| Eosinophil (%)                   | 0.0    | D-dimer (ng/mL FEU)              | 650             |
| Basophil (%)                     | 0.2    | Lymphocyte (10 <sup>3</sup> /μL) | 1.50            |
| Neutrophil (%)                   | 65.7   | Monocyte (10 <sup>3</sup> /μL)   | 0.47            |
| Lymphocyte (%)                   | 26.0   | HCT (%)                          | 41.6            |
| Monocyte (%)                     | 8.1    | RBS (mg/dL)                      | 104             |
| Eosinophil (10 <sup>3</sup> /μL) | 0.0    | BUN (mg/dL)                      | 8               |
| Basophil (10 <sup>3</sup> /μL)   | 0.01   | Creatinine (mg/dL)               | 0.64            |
| Neutrophil (10 <sup>3</sup> /μL) | 3.80   | SGOT (U/L)                       | 38              |
| Lymphocyte (10 <sup>3</sup> /μL) | 1.50   | SGPT (U/L)                       | 20              |
| Monocyte (10 <sup>3</sup> /μL)   | 0.47   | Natrium (mmol/L)                 | 139             |
| RBC ((10 <sup>6</sup> /μL)       | 4.58   | Kalium (mmol/L)                  | 3.7             |
| Hb (g/dL)                        | 13.3   | SARS-CoV-2                       | Positive        |
|                                  |        |                                  | CT value: 22.31 |

with cardiomegaly as seen in [Figure 1](#), the electrocardiography result within normal limit, and her laboratory result was within normal limit except the high D-dimer level as seen in [Table 1](#) below. On admission in the isolation ward, the patient was on non-invasive ventilation (NIV) with nasal cannula with oxygen 4 liters per minute and medical medications such as an intravenous fluid with NaCl 0.9% 20 drops per minute, vitamin C 1000 mg TID orally, vitamin D 1000 IU BID orally, zinc OD orally, N-acetylcysteine 300 mg BID orally, paracetamol 500 mg TID orally, omeprazole 40 mg BID orally, intravenous ranitidine, intravenous levofloxacin, oral rehydration salts suspension ad libitum, Lovenox subcutaneous, intravenous methylprednisolone, dextral syrup, and

salbutamol nebulizer.

On the ninth day of admission, the patient complained of shortness of breath. From the chest inspection, we found limited chest expansion and tachypnea breathing patterns. The patient then had physiotherapy treatment such as chest physiotherapy and breathing exercise. The chest physiotherapy and breathing exercise were done once daily due to her inadequate breathing effort. Every morning, physiotherapy given to the patients started with a breathing exercise, then chest physiotherapy-the exercise given with the patient in a sitting position without flexion of the shoulder and abdomen. The patient was then instructed to take a long and deep inspiration to make a full chest expansion and lung recoil, as shown in [Figure 2](#). After

four chest physiotherapy and breathing exercises, the shortness of breath and the patient’s breathing effort was improved. She was discharged from the hospital after 15 days of hospitalization.

## DISCUSSION

Patients with COVID-19 infection are at high risk for respiratory failure. Patients with COVID-19 have respiratory characteristics including hypoxemia condition and acute respiratory failure. The respiratory failure happened due to inadequate oxygen diffusion perfusion in the metabolism process marked by hypoxemia condition. Hypoxemia is the condition of a low level of oxygen in the blood. There are two types of respiratory failure, type I is hypoxemic type cause by oxygenation failure, and type II is hypercapnic type cause by the failure of alveolar ventilation.<sup>3,4</sup> The SARS-CoV-2 viruses enter through our respiratory system using the angiotensin-converting enzyme 2 (ACE-2) receptor in the lungs. Once it enters the lungs, the virus-induced the inflammation process, both innate and cellular inflammation. The inflammation process was causing the extravasation of inflammation products and failed oxygen diffusion perfusion, leading to a hypoxemic condition. The clinical manifestation of respiratory failure is increasing breathing effort marked by tachypnea and the usage of auxiliary respiratory muscle, retraction, and paradoxical breathing pattern.<sup>2,4</sup>

The patient in this case report didn’t complain of any shortness of breath on the admission, but on the ninth-day hospitalization, she started complaining of breathlessness and heavy breathing. The chest inspection found incomplete chest expansion and tachypnea breathing patterns. We conclude the patient has respiratory failure symptoms. Physiotherapy was then added to the patient management as adjuvant therapy besides oxygen therapy. The physiotherapy techniques we used are breathing exercise and chest physiotherapy.

Breathing exercise is one of the physiotherapy techniques that have proven to improve inspiration muscle strength. Breathing exercise includes exercise to improve a good inspiration marked by deep and long inspiration



**Figure 2.** Breathing exercise and chest physiotherapy done in a sitting position to improve the patient's breathing effort.

period, chest expansion exercise, postural improvement, and effective breathing with limitation of auxiliary respiratory muscle use. Breathing exercises aim to make a full chest expansion and good lung recoil. A full chest expansion will increase the thorax expansion and strengthen the inspiration and expiration of respiratory muscles, thus increasing the lungs' vital capacity.<sup>6-9</sup> Physiologically, breathing exercises will lift the abdomen and chest cavity and cause an increase in intrathoracic pressure. Deep inspiration will effectively open the small pores in the alveoli's epithelial cells and make collateral ventilation to the neighborhood clogged alveoli. Thus lung collapse due to clogged alveoli can be prevented. Deep and long inspiration will induce surfactant secretion produced by alveolar type II and increase chest expansion. It also helps to increase the number of expanded alveoli that increase the vital capacity of the lungs.<sup>2,10</sup>

Chest physiotherapy has been used in many different respiratory conditions, including COVID-19 infection. Chest physiotherapy is effective in helping sputum clearance and improves ventilation in COVID-19 patients. This physical therapy can improve the respiratory system's efficiency, increase chest expansion,

strengthen the respiratory muscles, and decrease sputum accumulation in the airways. Several studies suggest that chest therapy can improve gas exchange, limit pathological progression and reduce the need for ventilation support.<sup>6,9-11</sup> But the usage of chest physiotherapy alone in managing COVID-19 patients is not yet recommended, especially those with moderate to severe degree of infection. Breathing exercise and chest physiotherapy can be adjuvant therapy to improve the breathing effort besides oxygen therapy as the main treatment for the COVID-19 patient. Another study also stated the risk of aerosolization during the physical therapy exercise that can increase the rate of COVID-19 transmission. Thus all the physiotherapy should be arranged with safe and complete personal protection equipment.<sup>6,12</sup>

The chest physiotherapy intervention that has been recommended to use for COVID-19 patients are airway clearance techniques that were comprised of an active cycle of breathing techniques, forced expiratory techniques, percussion and vibration or clapping techniques, postural drainage, sputum clearance removal, and mobilization or exercise to trigger the sputum expectoration.<sup>6,10,12</sup> It is also

recommended that physical rehabilitation be done based on individual patient conditions since the COVID-19 patient has various clinical characteristics. The aim of chest physiotherapy for COVID-19 patients is to alleviate dyspnea and relieve anxiety in the short term. In the long term, it aims to improve physical functions, which will, in turn, improve the quality of life and daily living of the patient.<sup>12,13</sup>

Besides the acute settings, breathing exercise and chest physiotherapy may improve respiratory functions and quality of life in post-COVID-19 patients. During the acute phase, physical rehabilitation is used as adjuvant therapy. But in discharge condition or COVID-19 patients with a mild degree of infection, breathing exercise and chest therapy could be the main treatment to resolve the complaints.<sup>14,15</sup> The post-COVID-19 patient may still experience breathlessness due to lung fibrosis, or we named it with long COVID. The breathing exercise and chest therapy can be applied to the post-COVID-19 patients to improve their breathing capacity back to normal again.<sup>16</sup>

Our patient showed improvement in dyspnea and breathing difficulties after four series of physiotherapy. Several studies showed the benefit of physiotherapy for COVID-19 patients. A study by Calvo-Aya et al. showed that physiotherapy has proven effective for improving long-term function among COVID-19 patient survivor that admitted to ICU.<sup>5</sup> Study by Vitacca et al. did a research of respiratory rehabilitation role in three groups of COVID-19 patients in the acute phase, with critical respiratory impairment and severe respiratory impairment, they suggested that respiratory physiotherapy can be applied with safety and careful way including healthcare staff training and proper use of personal protective equipment to minimize the COVID-19 transmission risk.<sup>8</sup> Meta-analysis of 24 randomized controlled trials by Lewis et al. showed that breathing exercise was associated with higher sputum clearance, vital capacity, and forced expiratory volume compared with the non-intervention group. This study also suggests that the exercise must be performed with personal protective equipment in a negative-pressure room.<sup>17</sup>



Our patient, in this case report, is in a stable condition, despite her shortness of breath. Non-invasive ventilation support is needed in our patients. Our patient was also fully alert and able to do the physiotherapist's instruction. Abdullahi et al. stated that physiotherapy like breathing exercises and chest therapy could be done if the patient can obey the physiotherapist's instruction and the patient has reached minimum clinical stability.<sup>15,18</sup> The physical rehabilitative should be withdrawn in case of high fever, worsening dyspnea, increasing respiratory rate more than 30x/minutes, oxygen saturation <93%, bradycardia or tachycardia, arrhythmia, shock, or mental alteration.<sup>11,12</sup>

The limitation of this study is the benefit of physiotherapy intervention in COVID-19 patients still influenced by other factors like medical management and oxygen therapy. A more superior study design such as randomized controlled trial will give a better result of the research findings.

## CONCLUSION

This case report reported a case of COVID-19 infection in a 53-year-old female patient with shortness of breath. Breathing exercises and chest therapy aim to make a full chest expansion and good recoil of the lungs, thus improving oxygen perfusion and diffusion process. Breathing exercises and chest physiotherapy did in our patient help to improve her symptoms and breathing effort after four series of physiotherapy.

## CONFLICT OF INTEREST

The authors declare that there is no competing interest regarding the manuscript.

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## AUTHOR CONTRIBUTION

All of the authors equally contributed to the study from the conceptual framework, data gathering, and data analysis until

interpreting the study results.

## ETHIC CONSIDERATION

This patient in this study has understood and agreed to the use of patient personal data related to the writing of scientific articles. The patient also gave informed consent consciously regarding the use of the data obtained for the preparation of articles to be published in scientific journals.

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