

CASE REPORT

INTENSIVE CARE

The role of early rehabilitation in the ICU management of a severe COVID-19 patient: a case report

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ABSTRACT

Patients admitted to the intensive care unit (ICU) with severe COVID-19, are at high risk of developing ICU acquired weakness and deconditioning syndrome. Early rehabilitation is a critical therapeutic intervention to reduce the complications of immobilization. We present the case of a 51-year-old woman with acute respiratory distress syndrome (ARDS) due to COVID-19. The patient underwent early rehabilitation program, starting from her fourth day after ICU admission. The rehabilitation program included: (1) prone and semi-prone positioning; (2) respiratory exercises, such as diaphragmatic deep breathing, chest stretch, and effective coughing; (3) other exercises which included mobilization, range of motion exercises, and joint relaxation. The patient's respiratory function eventually improved (as indicated by improved SpO₂). Her ability to perform activities of daily living also improved so that she was able to walk independently to the toilet without respiratory distress. Although further research is required, this report suggests that patients with severe COVID-19 admitted to the ICU will benefit from early rehabilitation program.

Key words: SARS CoV-2; COVID-19; Early Rehabilitation; Mobilization; Breathing Exercises

Citation: Rosyalynda H. The role of early rehabilitation in the ICU management of a severe COVID-19 patient: a case report. *Anaesth. pain intensive care* 2023;27(6):783–785; DOI: [10.35975/apic.v27i6.2092](https://doi.org/10.35975/apic.v27i6.2092)

Received: September 03, 2023; **Reviewed:** September 16, 2023; **Accepted:** September 16, 2023

1. INTRODUCTION

Severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) has become a major public health issue since the end of 2019. The highly transmissible SARS-CoV-2 has put a huge burden on the healthcare systems. A systematic review by Rodriguez-Morales et al. found that 20.3% of patients with COVID-19 require intensive care unit (ICU) admission and almost 75% of patients with COVID-19 admitted to the ICU need invasive mechanical ventilation (IMV).¹

Patients with severe COVID-19 admitted to the ICU are at high risk of developing ICU-acquired weakness (ICU-AW), as well as disuse syndrome. ICU-AW occurs as a consequence of prolonged immobilization which leads to myopathy, neuropathy, and ventilator dependency.² A previous cohort study by Di Pietro et al. reported that patients with generalized muscle weakness after COVID-

19 were more likely to have axonal and asymmetric polyneuropathy.³ Rehabilitation program plays an important role in reducing the risk of ICU-AW. A study by Kaderet et al. (2022) indicated that breathing exercise, even for a short period, effectively improve specific respiratory parameters in moderate to severe COVID-19 patient.⁴ The ICU Liberation: ABCDEF Bundle (where E stands for Early Mobility and Exercises) showed significant and clinically meaningful improvements in outcomes including survival, mechanical ventilation use, coma, delirium, restraint-free care, ICU readmissions, and post-ICU discharge disposition.⁵

Although ICU-AW is an increasingly recognized problem, research or data related to the incidence and prevalence of ICU-AW, especially in COVID-19 patients remains limited. In this case report, we emphasize the important role of early rehabilitation for

COVID-19 patient, who developed acute respiratory distress syndrome (ARDS).

2. CASE REPORT

A 51-year-old woman with a history of diabetes mellitus type II, hypertension stage II, and obesity grade II, was diagnosed with SARS-CoV-2 infection at the end of June 2021 based on positive nasopharyngeal swab polymerase chain reaction (PCR) test. She was immediately admitted to the isolation ward. Her body temperature was 39.4°C, respiratory rate 28-32/min, pulse rate 112 bpm, and blood pressure 140/80 mmHg. Her SpO₂ was 90-92%.

We found rhonchi on both sides of her chest. Laboratory findings showed that she had leukocytosis (13,500/mm³). Other laboratory findings, e.g., hemoglobin, platelets, bilirubin, urea and creatinine, were normal. Her blood glucose was also normal (controlled using metformin). Her chest x-ray showed non-homogeneous ground-glass opacity appearance at subpleural zone on her right lung which indicated signs of pneumonia suspected due to COVID-19. The patient was initially put on non-face-breathing facemask (NRM), and her SpO₂ was 94-95% with 10 L of oxygen. Antivirus (favipiravir) and fluoroquinolones were initiated. Treatment for diabetes mellitus (metformin and insulin intramuscular) was continued.

On the fourth day of treatment, her SpO₂ dropped to 84-88% with non-rebreathing mask. Arterial blood analysis revealed that her PF ratio (arterial PO₂ divided by the FiO₂) dropped to 53.8, thus a diagnosis of severe acute

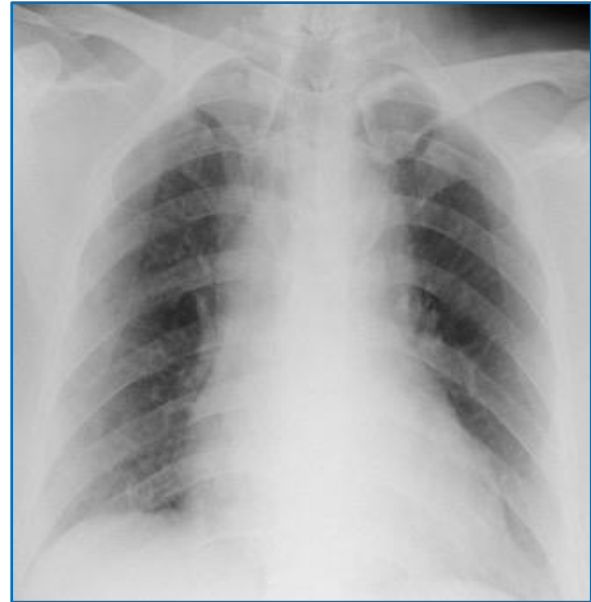


Figure 1: Chest X-ray showing non-homogeneous ground-glass opacities

respiratory distress syndrome (ARDS) was established. The patient was transferred to the ICU and received oxygenation with high flow nasal cannula (HFNC) at 60 L/min, FiO₂ 100%, so that her SpO₂ increased to 85-90%.

As soon as the patient was transferred, the patient underwent the following rehabilitation interventions:

- (1) respiratory exercises twice a day to increase breathing function, which included diaphragmatic deep

Table 1: Patient's vital signs, respiratory function, and general conditions showing gradual improvement													
0	1	4 (pre)	4 (post)	5	6	7	8	9	10	11	12		
	Isolation Ward		ICU Isolation							Isolation Ward			
	Rehabilitation Program												
Oxygen Support	NRM 10 L/min		HFNC FR 60 L/min, FiO ₂ 100%			HFNC FR 60 L/min, FiO ₂ 80%		HFNC FR 40 L/min, FiO ₂ 70%		HFNC FR 40 L/min, FiO ₂ 50%		Face Mask 6-8 L/min	Nasal Cannula 2-4 L/min
Consciousness	CM	CM	CM	CM	CM	CM	CM	CM	CM	CM	CM	CM	
Subjective Assessment	Dyspnea, Hard Cough				Dyspnea gone, cough getting better						Mild Cough		
BP (mmHg)	140/80	140/80											
Heart Rate (bpm)	110-115	90-100	80-90	80-90	70-85	70-80	80-90	70-80	80-90	70-80	80-90		
Temp (°C)	39-39.4	38-39	37.8-38	37.5-37.8	37.5-37.8	37-37.2	36.5-37	36.5-37	36-36.5	36-36.5	36-36.5		
SpO₂ (%)	94-95	84-88	85-90	85-91	91-94	91-95	91-95	92-96	93-99	95-98	95-98		
Physical Activity	Sitting at the edge of the bed						Standing independently			Walking independently			

breathing, chest stretch, and breath counting test; (2) in-bed positioning every 2 h to prevent decubitus ulcer formation, which included prone positioning for 6 h a day and semi-prone positioning every 2 h; (3) other exercises to prevent contractures due to immobilization, which included mobilization, range of motion exercises, and joint relaxation.

After the rehabilitation program in the ICU was completed, she was able to be transferred to the ward. Her SpO₂ was above 95% with non-rebreathing mask, which indicated improvement of respiratory function. Her muscle strength now ranged between 4 and 5 based on the Manual Muscle Testing Scale and she was able to independently walk to the toilet without experiencing any respiratory distress (Table 1).

3. DISCUSSION

In addition to disuse syndrome, patients with COVID-19 are at higher risk of developing ICU-AW. For patients managed in the ICU, rehabilitation should be provided as early as possible. A systematic review by Goodwin et al. reported that exercise, early mobilization, and multicomponent programs may improve recovery after ICU admission for severe respiratory illness.⁶ Another systematic review by Bernal-Utrera et al. concluded that physical therapy for patients with COVID-19 admitted to the ICU is a necessary strategy to prevent complications and contribute to the stabilization of patients in critical periods, facilitating their recovery.⁷

This patient was in ARDS when she was admitted to the ICU, and after early rehabilitation program, her respiratory and physical function improved. This showed the need for early mobilization and exercises for COVID-19 inpatients in order to improve patient's recovery and prevent ICU-AW.

To date no validated guideline of interventions has been established, especially in terms of rehabilitation for severe COVID-19 in the ICU. However, there is a consensus of recommendations for severe to critical COVID-19 rehabilitation, such as the adoption of breathing training in prone or semi-recumbent bed position, moderate head elevation, limb mobilization, as well as sitting and standing at bedside.⁸ Early pulmonary rehabilitation including controlled respiration, airway clearance techniques, and strengthening of inspiratory muscles are important to maintain and improve lung capacity. Appropriate positioning in bed prevents long-term contractures and pressure injuries.⁹

4. CONCLUSION

Early rehabilitation program improves respiratory and

physical functions in patient with severe COVID-19. Although further research is needed, our results suggest that early exercises and mobilization program may be beneficial for patient with severe COVID-19 admitted to the ICU, as it improves their recovery.

5. Competing Interests

The authors have full access to all the data, take full responsibility for the accuracy of the data.

6. Authors contribution

All authors contributed equally in this case report.

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