

Introduction

This study aims to report the clinical progression and recovery of respiratory and physical functions through early multidisciplinary rehabilitation in an immunocompromised patient with severe acute respiratory distress syndrome (ARDS) requiring veno-venous extracorporeal membrane oxygenation (VV-ECMO).

Participant and Methods

A 73-year-old female with rheumatoid arthritis was admitted on October 29, 2025, for lung abscess and severe pneumonia. Initial chest computed tomography (CT) confirmed extensive pulmonary lesions (Figure 1). The patient received mechanical ventilation, CRRT, and VV-ECMO. Comprehensive rehabilitation commenced on post-admission day 2. Physical function was serially assessed using the Chelsea Critical Care Physical Assessment Tool (CPAx) (Table 1). Respiratory functions were evaluated via pulmonary function tests (PFT), maximal inspiratory/expiratory pressures (MIP/MEP), peak cough flow (PCF), and the 6-minute walk test (6MWT). To mitigate sarcopenia, high-protein nutritional support (1.5 g/kg) and resistance exercises were integrated, with recovery monitored through Phase Angle and Skeletal Muscle Index (SMI) via bioelectrical impedance analysis. Exercise training was conducted under supplemental oxygen (1–2 L/min via nasal cannula) to prevent exertional hypoxemia and to improve exercise tolerance.

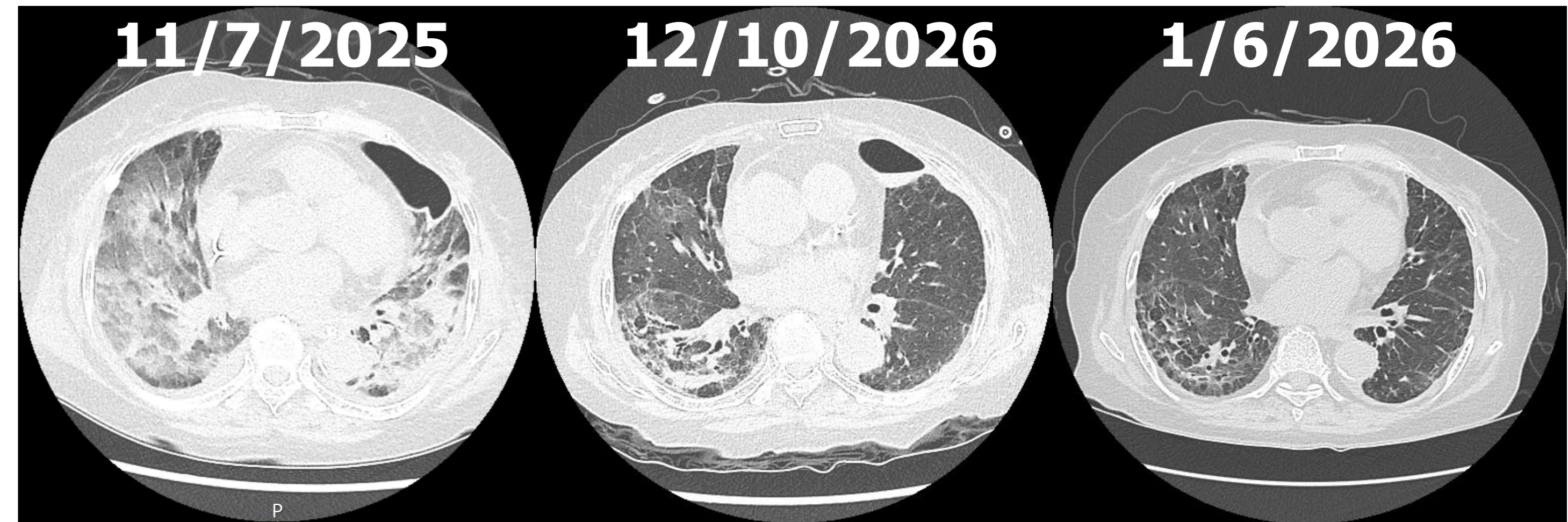


Fig 1. Serial changes in chest computed tomography (CT) scans from admission to recovery

Table 1. Serial changes in the Chelsea Critical Care Physical Assessment Tool (CPAx) scores during the hospital stay

	Respiratory function	Cough	Rolling	Supine to sit edge	Dynamic sitting balance	Standing balance	Sit to stand	Transfer to chair	Stepping	Grip strength	Total score
2025.10.31.	1	2	3	0	0	0	0	0	0	3	9
Tracheostomy(11/5), PT : PROM, AAROM, sitting, RPT : Deep breathing, Coughing training											
2025.11.17.	1	2	1	0	0	0	0	0	0	2	6
PT : AROM, sitting, dangling, RPT : Percussion, Coughing training in side lying position											
2025.11.24.	1	2	4	3	2	0	0	0	0	2	14
PT : resistance exercise, dangling, RPT : Percussion, Coughing training in dangling position											
2025.12.03.	2	3	4	3	2	2	2	0	0	3	21
Vent weaning start(12/8), PT : resistance exercise, standing, RPT : Deep breathing, IMT/PEP											
2025.12.17.	3	5	4	3	4	3	3	3	2	2	32
Vent weaning(12/29), PT : maintain standing position, walker gait training, RPT : Deep breathing, IMT/PEP											
2025.12.31.	5	5	5	3	4	4	4	4	4	3	41
Decannulation(1/5), PT : walker gait training, mono cane gait training, RPT : Deep breathing, IMT/PEP											
2026.01.14.	4	5	5	4	5	5	5	5	4	2	44
PT : Stair up training, RPT : air stacking exercise, IMT/PEP											
2026.01.21.	4	5	5	5	5	5	5	5	4	3	46

PT, Physical Therapy; PROM, Passive Range of Motion; AAROM, Active Assisted Range of Motion; RPT, Respiratory Physical Therapy

Results

Following critical care, the patient was successfully decannulated on January 5, 2026, approximately two months after admission (Figure 2). The CPAx score, which reached a nadir of 6 due to acute clinical deterioration, improved significantly to 46 by January 21, 2026. Although FVC remained at approximately 40% of the predicted value, PCF increased from 70 to 230 L/min, and MEP improved from 33 to 73 cmH₂O, facilitating airway clearance. The 6MWT reached 309 m with IV pole assistance. The patient's functional status progressed from bedbound to independent cane ambulation with supervision. Phase Angle rebounded from 2.8° to 3.4°, and SMI recovered from 4.1 to 5.3 kg/m², indicating qualitative cellular and musculoskeletal restoration. The patient was discharged home on January 21, 2026.

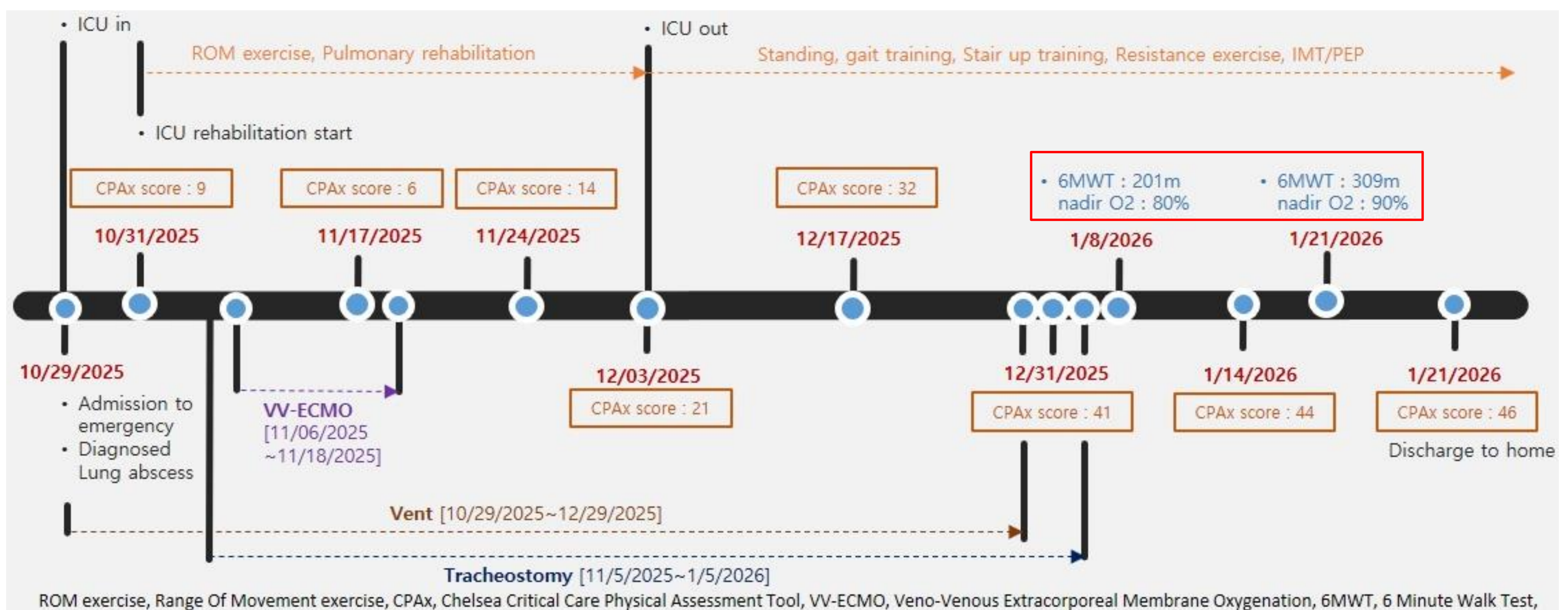


Fig 2. Clinical timeline of the patient's progress from admission to discharge

Conclusion

Early systematic rehabilitation is pivotal for recovery in critically ill ARDS patients on ECMO, particularly those vulnerable to muscle wasting due to immunosuppression. Integrating respiratory therapy, nutritional optimization, and resistance training minimizes intensive care unit-acquired weakness (ICUAW) and facilitates a rapid return to activities of daily living. However, long-term follow-up is essential due to residual impairment in diffusing capacity and exertional hypoxemia.