

Clinical Letter

Use of Extracorporeal Carbon Dioxide Removal Therapy in an Intermediate Respiratory Care Unit



To the Director,

Extracorporeal carbon dioxide removal (ECCO₂R) is an advanced form of life support that is mostly used in patients with acute respiratory distress syndrome (ARDS) and severe acute exacerbations of chronic obstructive pulmonary disease (COPD) or asthma.^{1,2} For the former, ECCO₂R therapy allows ultra-protective lung ventilation and reduces ventilator-induced lung injury. For the latter, ECCO₂R therapy may be applied to prevent intubation in patients at risk of non-invasive ventilation (NIV) failure.^{3,4} Due to the need for venous cannulation and complexity of care, this technique is mainly used in Intensive Care Units (ICU).⁵ We present a case of successful treatment with a peristaltic pump ECCO₂R in an Intermediate Respiratory Care Unit (IRCU).

A 67-year-old male with a history of progressive pulmonary fibrosis after COVID-19 (Fig. 1), referred for evaluation for lung transplant at last pneumology follow-up, was admitted to the hospital because of severe respiratory insufficiency. His medical record included chronic lymphocytic leukaemia (in remission), pulmonary embolism and atrial fibrillation on anticoagulation. He presented with a recent onset of dyspnoea, cough with purulent sputum, fever and increased oxygen requirement. Blood pressure was 122/65 mmHg, pulse 100 bpm, SaO₂/FiO₂ 112, and a respiratory rate of 40 bpm with scattered bilateral crackles. Blood gases showed respiratory acidosis (pH 7.27, pCO₂ 116 mmHg, pO₂ 38 mmHg, HCO₃ 53.3 mM/L). A chest X-ray revealed a known interstitial pulmonary infiltrate without significant changes com-

pared to his previous one. Laboratory studies showed an increased C-reactive protein (136.0 mg/L), leukocytosis ($14.70 \times 10^3/\mu\text{L}$), and neutrophilia ($10.90 \times 10^3/\mu\text{L}$). Since the patient had a do-not-intubate order, he was admitted to the IRCU.

NIV was started but, after 24 h, the condition of the patient did not improve. Faced with this situation of non-invasive measures failure in a patient pending evaluation for lung transplant with a potentially reversible acute worsening due to an infectious disease as the most likely cause, the patient was connected to an ECCO₂R device (PrismaLung+, Baxter) and empirical antibiotic treatment was started. Blood flow was kept between 250 and 300 ml/min and gas flow (oxygen) at 6–8 L/min, which was well tolerated by the patient, being able to withdraw NIV and deescalate to high-flow and finally conventional nasal cannulas. At the beginning of treatment ABG showed pH 7.4, pCO₂ 93 mmHg, pO₂ 88 mmHg and HCO₃ 57.6 mM/L (PaO₂/FiO₂ 110), with persisting tachypnea (40 bpm) and work of breathing. After 24 h, ABG improved to pH 7.43, pCO₂ 60 mmHg, pO₂ 54 mmHg, HCO₃ 39.8 mmHg with respiratory rate around 20 bpm, PaO₂/FiO₂ 135 and no dyspnoea. As the patient's clinical condition improved following medical treatment, it was possible to withdraw ECCO₂R after 6 days and the patient was discharged home.

The use of ECCO₂R has been reported in the ICU setting. This case represents the potential use of ECCO₂R in an IRCU in reversible situations refractory to non-invasive measures. Further research is required to determine the best way to implement this therapy in IRCU, to maximize its benefits while minimizing any potential risks.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest

Esther Barbero Ph.D. None.

Antonio Gomis M.D. Has received lectures honoraria from Baxter International Inc., Deerfield, Illinois.

David Pestaña Ph.D. Has received honoraria from Baxter International Inc. Baxter International Inc., Deerfield, Illinois; and B. Braun Medical S.A.

Artificial intelligence involvement

Help of any artificial intelligence software or tool has not been use for this publication.

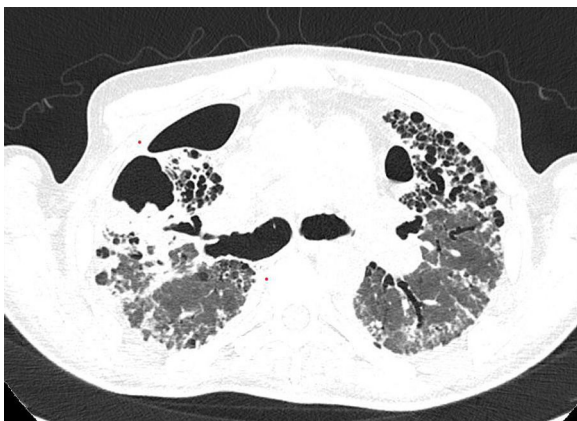


Fig. 1. Chest CT scan of the patient before admission.

References

1. Morelli A, Del Sorbo L, Pesenti A, Ranieri VM, Fan E. Extracorporeal carbon dioxide removal (ECCO2R) in patients with acute respiratory failure. *Intensive Care Med.* 2017;43:519–30.
2. Bromberger BJ, Agerstrand C, Abrams D, Serra A, Apsel D, Tipograf Y, et al. Extracorporeal carbon dioxide removal in the treatment of status asthmaticus. *Crit Care Med.* 2020;48:e1226–31.
3. Del Sorbo L, Pisani L, Filippini C, Fanelli V, Fasano L, Terragni P, et al. Extracorporeal CO₂ removal in hypercapnic patients at risk of noninvasive ventilation failure: a matched cohort study with historical control. *Crit Care Med.* 2015;43:120–7.
4. Combes A, Fanelli V, Pham T, Ranieri VM. European Society of Intensive Care Medicine Trials Group and the “Strategy of ultra-protective lung ventilation with extracorporeal CO₂ removal for new-onset moderate to severe ARDS” (SUPERNOVA) investigators. Feasibility and safety of extracorporeal CO₂ removal to enhance protective ventilation in acute respiratory distress syndrome: the SUPERNOVA study. *Intensive Care Med.* 2019;45:592–600.
5. Braune S, Burchardi H, Engel M, Nierhaus A, Ebelt H, Metschke M, et al. The use of extracorporeal carbon dioxide removal to avoid intubation in patients failing non-invasive ventilation – a cost analysis. *BMC Anesthesiol.* 2015;15:160.

Esther Barbero ^{a,*}, Antonio Gomis ^b, David Pestaña ^c

^a *Intermediate Respiratory Care Unit, Respiratory Service, Ramón y Cajal University Hospital, IRYCIS, School of Medicina-Alcalá de Henares University, Madrid, Spain*

^b *Nephrology Service, Ramón y Cajal Hospital, Ramón y Cajal University Hospital, IRYCIS, School of Medicina-Alcalá de Henares University, Madrid, Spain*

^c *Anaesthesia and Resuscitation Service, Ramón y Cajal University Hospital, IRYCIS, School of Medicina-Alcalá de Henares University, Madrid, Spain*

* Corresponding author.

E-mail address: estherbarbero@gmail.com (E. Barbero).