

Extracorporeal CO₂ removal: The minimally invasive approach

Dott.ssa ELEONORA DUSCIO (1)(2), Dott. FRANCESCO CIPULLI (1), Dott. FRANCESCO VASQUES (1), Dott.ssa FRANCESCA COLLINO (1), Dott.ssa FRANCESCA RAPETTI (1), Dott. TOMMASO TONETTI (1), Dott.ssa FEDERICA ROMITTI (1), Prof. MICHAEL QUINTEL (1), Prof. LUCIANO GATTINONI (1)

(1) Department of Anesthesiology, Emergency and Intensive Care Medicine, University of Göttingen, Goettingen, Germania.

(2) Università degli Studi di Milano, Milano, Italia.

Argomento: Insufficienza respiratoria acuta e ventilazione meccanica

Background

Minimally invasive extracorporeal CO₂ removal (ECCO₂R) is a widely accepted supportive treatment in COPD patients. Conversely the potential of such technique in treating ARDS patients has still to be investigated. The aim of this study was to quantify the ECCO₂R of a v-v apparatus (Estor ProLUNG Plus MD, Estor®) in an experimental model measuring artificial and natural lung CO₂ removal in different conditions. We evaluated the efficiency of the system as absolute ECCO₂R, ECCO₂R/total VCO₂ ratio and decrease of mechanical ventilation.

Methods

Eight healthy pigs (57.7 ± 5 kg) were sedated, ventilated and connected to the Estor proLUNG system (surface 1.8 m², priming volume 150 mL) through a 13 French catheter (Joline®). The ECCO₂R was measured in different combinations of input PCO₂ (38.9 ± 3.3, 65 ± 5.7 and 90 ± 12 mmHg), extracorporeal blood flow (100, 200, 300 and 400 mL/min) and gas flow (4, 6 and 12 L/min). At each setting we measured also natural lung CO₂ removal, lung mechanics and blood gasses.

Results

ECCO₂R increased linearly with extracorporeal blood flow and input PCO₂, while it was not affected by gas flow. The output PCO₂ was similar (7.5 ± 2.3, 8.9 ± 3.2, 8.5 ± 3.1 mmHg, p0,064) among the input PCO₂ groups regardless of the blood flow, suggesting that ECCO₂R was always maximized. Maximum ECCO₂R was 171 mL/min at an input PCO₂ of 94 mmHg, and blood flow 400 mL/min. The ECCO₂R /total VCO₂ ratio ranged between 0.7 and 1. At a PaCO₂ of 55 mmHg an ECCO₂R /total VCO₂ ratio of 50% allowed a minute ventilation of 2 L/min.

Conclusion

Estor proLUNG system allows a relevant ECCO₂R with consequent significative reduction of mechanical ventilation, therefore it should be evaluated in moderate-severe ARDS patients.