

End-tidal to Arterial PCO₂ ratio as a guide to weaning from Veno-Venous Extracorporeal Membrane Oxygenation

Dott. MARA VELATI (1), Dott. STEFANO LAZZARI (1), Dott. FEDERICA ROMITTI (1), Dott. MATTIA BUSANA (1), Dott. ROSANNA D'ALBO (1), Dott. CARMELO ZINNATO (1), Dott. SERENA BRUSATORI (1), Dott. ROBERTA MAJ (1), Dott. SIMONE GATTARELLO (1), Dott. FABIO LOMBARDO (1), Prof. ONNEN MOERER (1), Prof. MICHAEL QUINTEL (1), Prof. LUIGI CAMPOROTA (2), Prof. LUCIANO GATTINONI (1)

(1) Department of Anesthesiology, Medical University of Göttingen, University Medical Center Goettingen, Robert-Koch-Strasse 40, Goettingen, Lower Saxony, Germania.

(2) Department of Adult Critical Care, Guy's and St Thomas' NHS Foundation Trust, Health Centre for Human and Applied Physiological Sciences,, Westminster Bridge Road, London Se1 7eh, Regno Unito.

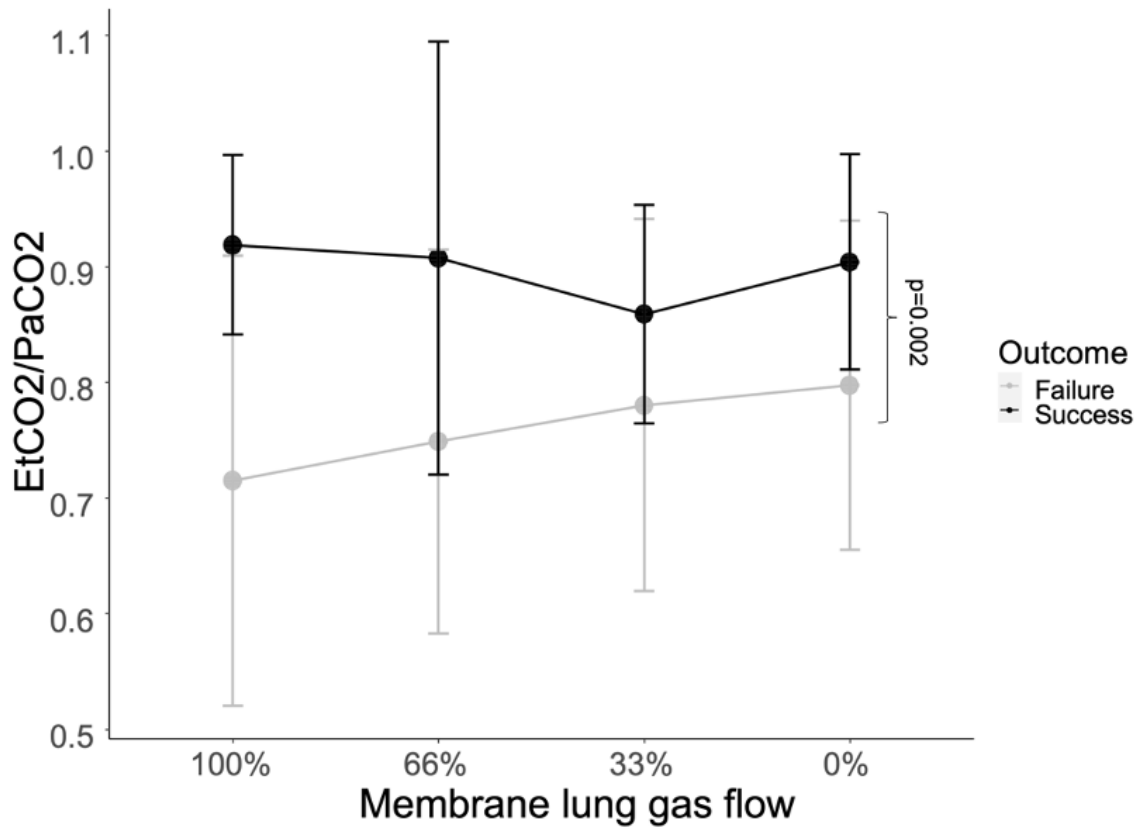
Argomento: ECMO

Background: We investigated the physiological determinants of weaning failure in patients undergoing Veno-Venous Extracorporeal Membrane Oxygenation (VV-ECMO) and its predictive variables during a protocolized weaning process.

Methods: The study population included two cohorts. In the prospective physiological cohort (n=26), O₂ consumption, CO₂ production (natural and membrane lung), gas-exchange and esophageal pressure swing were measured along 4 steps of progressive, 33% sweep gas flow reduction to 0 l/min. A complete measurement was performed after 20 minutes of equilibration time. Weaning was successful when Pes swing ≤ 15 cmH₂O; RR ≤ 30 bpm; arterial pH > 7.25 ; PaCO₂ ≤ 60 mmHg; PaO₂ ≥ 70 mmHg with FiO₂NaturalLung $\leq 60\%$. The findings were further assessed in a retrospective clinical cohort (n=638).

Results: In the physiological cohort, weaning failure occurred in 42% of patients, either because inspiratory effort exceeded 15 cmH₂O or the respiratory rate was above the 30 bpm threshold (70% of cases). All patients had comparable total lung VCO₂ and increased minute ventilation to maintain PaCO₂ constant. However, the inspiratory effort to eliminate one unit-volume of CO₂ nearly doubled at 0 l/min sweep gas flow in subjects who failed weaning attempts [68.9 (42.4,123) vs. 39 (20.1,57) [cmH₂O/(L/min)], p=0.007], due to a significantly high physiological dead space [68 (58, 73)% vs. 54 (41, 64)%; p=0.012]. The only clinical predictor of weaning failure was the baseline PetCO₂/PaCO₂, AUC: 0.87 (95%CI 0.71 - 1.0). In the clinical cohort, weaning failure was 37% (p=0,58). In this population also, the strongest predictor of weaning outcome was PetCO₂/PaCO₂ both at weaning initiation (OR 4.14; 95% CI 1.32 - 12.2; p=0.015) and 0 l/min sweep gas flow (OR 13.1; 95% CI 4.0 - 44.4; p<0.001).

Conclusions: The most significant reason underlying VV-ECMO weaning failure is the inability to clear CO₂. PetCO₂/PaCO₂, strongly dependent on both dead space and venous admixture, was the strongest predictor of weaning outcome before weaning initiation.



ROC curves of EtCO₂/PaCO₂ at baseline

