

POSTER PRESENTATION

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Artificial lung gas exchanges depend on ECMO settings

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Introduction

Artificial membrane lung (AL) gas exchanges are usually evaluated according to $\text{PaO}_2/\text{FiO}_2$ ratio. In addition, dead space ventilation and shunt fraction can be measured by the same equations used for native lungs [1].

Objectives

To study the effect of AL settings - gas flow (GF), blood flow (BF) and FiO_2 - on AL $\text{PaO}_2/\text{FiO}_2$ ratio, dead space and shunt, to suggest how to properly monitor these parameters.

Methods

We performed three different tests:

- GF changes (from 1 to 10 L/min) in 8 AL at clinically set BF and FiO_2 ;
- BF changes in 6 AL at constant FiO_2 (1) and GF (10 L/min);
- $\text{FiO}_2 = 1$ vs. clinically set FiO_2 in 10 AL at clinically set BF and GF.

We performed pre- and post-oxygenator blood gas analysis and measured CO_2 at AL exhaust port by side-stream capnography, in order to evaluate $\text{PaO}_2/\text{FiO}_2$ ratio, dead space and shunt.

Results

a) At clinically set BF (4.0 ± 0.9 L/min) and FiO_2 (0.87 ± 0.15), $\text{PaO}_2/\text{FiO}_2$ ratio did not correlate with GF, whereas dead space progressively increased with GF ($R = 0.7904$, $p < 0.0001$) (Figure 1).

b) Data were collected at basal (3.3 ± 0.7 L/min), increased (4.1 ± 0.8 L/min) and decreased (2.5 ± 0.6 L/min) BF. With the progressive increase of BF, dead space did not change, whereas $\text{PaO}_2/\text{FiO}_2$ ratio decreased and shunt increased ($p < 0.001$) (Figure 2).

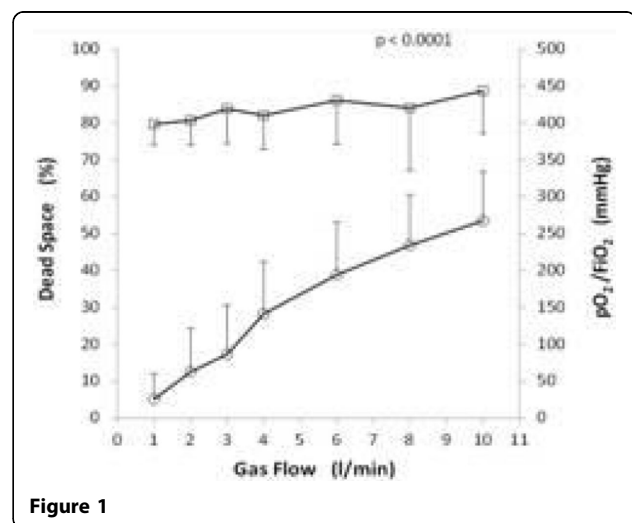


Figure 1

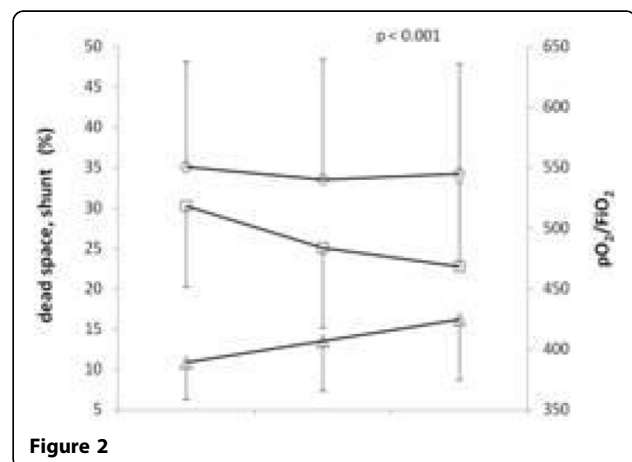


Figure 2

c) At clinically set BF (3.5 ± 1.1 L/min) and GF (5.1 ± 2.4 L/min), the mean difference \pm standard deviation of PaO₂/FiO₂ ratio and shunt obtained at clinically set (0.80 ± 0.20) vs. FiO₂ = 1 was -76 ± 109 mmHg and $2.1 \pm 11.6\%$, respectively.

Conclusions

To properly monitor AL CO₂ removal and oxygen transfer, evaluations should be performed at constant GF and at FiO₂ = 1 and constant BF, respectively.

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Reference

1. Castagna L, Zanella A, Scaravilli V, Magni F, Deab SA, Introna M, *et al*: Effects on membrane lung gas exchange of an intermittent high gas flow recruitment maneuver: preliminary data in veno-venous ECMO patients. *J Artif Organs* 2015 Mar 26, [Epub ahead of print].

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