Letter

# Surfactant therapy and extracorporeal life support

Frans B Plötz

Pediatric Intensivist, VU Medical Center, Department of Pediatric Intensive Care, Amsterdam, The Netherlands

Corresponding author: Frans B Plötz, fb.plotz@vumc.nl

Published: 8 December 2005
This article is online at http://ccforum.com/content/10/1/401


*Critical Care* 2006, **10:**401 (doi:10.1186/cc3933)

See related research by Hermon *et al*. in issue 9.6 [http://ccforum/content/9/6/R718]

I read with great interest the article by Hermon and coworkers [1], who reported that surfactant application in children with severe respiratory failure treated with extracorporeal membrane oxygenation was associated with improved lung volume and pulmonary mechanics. Although these findings must be confirmed in prospective studies, they are very promising. Based on a series of animal studies, more than 10 years ago we advocated use of a combination of surfactant therapy and extracorporeal life support in the treatment of severe respiratory failure. We found that one effective option is to combine intratracheal instillation of a large fluid volume with diluted surfactant and LFV-ECCO2R (low frequency ventilation and extracorporeal carbon dioxide removal).

In animal studies using $^{141}$Ce-labelled microspheres mixed with the surfactant [2,3], we observed that, following endotracheal administration, this surfactant preparation was distributed inhomogeneously in the lungs. However, significantly improved distribution was achieved when this dose of surfactant (100 mg/kg body weight) was diluted with normal saline to a concentration of 6.25 g/l. In order to apply this dose, intratracheal fluid administration of 16.0 ml/kg body weight was required. Subsequently, we evaluated the effect of large volume fluid installation in lung lavaged rabbits while applying two gas exchange techniques, namely continuous positive pressure ventilation and LFV-ECCO2R [4]. We observed significantly higher arterial oxygen tension in the LFV-ECCO2R group than in the control group in the normocapnic state.

Based on these promising findings we further explored weaning possibilities [5]. Four hours after surfactant instillation in lung lavaged rabbits, the inspired fraction of oxygen could be decreased to 40% in a stepwise manner, such that arterial oxygen tension could easily be maintained within the normal range. Extracorporeal flow rates during perfusion ranged from 20 to 35 ml/kg per min and were sufficient to keep the arterial carbon dioxide tension and pH within normal limits. After 4 hours, the lung lavaged rabbits could breathe spontaneously with continuous positive airway pressure and 40% oxygen, and normal blood gas values were maintained. Using LFV-ECCO2R we required flow rates of only 20–35 ml/kg per min and were able to use a small, compact circuit, thereby minimizing the additional adverse effects of an extracorporeal circuit [6,7]. Our findings indicate that barotrauma/volutrauma due to mechanical ventilation and oxygen toxicity due to high fraction of inspired oxygen can be minimized in an animal model of acute severe respiratory failure using combined LFV-ECCO2R and surfactant therapy.

I hope that this additional information will stimulate the authors to explore further the clinical application of surfactant and extracorporeal life support.

## Competing interests

The author(s) declare that they have no competing interests.

## References

1. Hermon M, Burda G, Male C, Boigner H, Ponhold W, Khoss A, Strohmaier W, Trittenwein G: **Surfactant application during extracorporeal mebrane oxygenation improves lung volume and pulmonary mechanics in children with respiratory failre.** *Crit Care* 2005, **9:**R718-R725.
2. van der Bleek J, Plötz FB, van Overbeek F, Heikamp A, Wildevuur ChRH, Okken A, Bambang Oetomo S: **The distribution of exogenous surfactant in rabbits with severe respiratory failure: the effect of volume.** *Pediatr Res* 1993, **34:**154-158.
3. Plötz FB, Stevens H, Heikamp A, Bambang Oetomo S: **The distribution of a second dose of surfactant in rabbits with severe respiratory failure.** *Pediatr Res* 1995, **37:**476-481.
4. Plötz FB, Mook PH, Heikamp A, Brus F, Okken A, Bambang Oetomo S, Wildevuur ChRH: **Large volume instillation of surfactant during extracorporeal life support improves lung function in lung lavaged rabbits.** *ASAIO J* 1993, **39:**470-474.
5. Plötz FB, Mook PH, Jansen NJG, Bambang Oetomo S, Wildevuur ChRH: **Reduction in adverse effects of mechanical ventilation in rabbits with acute respiratory failure by treatment with extracorporeal $CO_2$ removal and large fluid volume of diluted surfactant.** *ASAIO J* 1997, **43:**916-921.
6. Plötz FB, Wildevuur W, Delius RE, Bartlett RH, Wildevuur ChRH: **Platelet consumption and blood requirements during neonatal extracorporeal life support (ECLS).** *Perfusion* 1992, **7:**27-33.
7. Plötz FB, Oeveren W van, Bartlett RH, Wildevuur ChRH: **Blood activation during neonatal extracorporeal life support (ECLS).** *J Thorac Cardiovasc Surg* 1993, **105:**823-832.