

Poster Presentations

SURFACTANT DISATURATED-PHOSPHATIDYLCHOLINE TURNOVER AND POOL SIZE IN HUMANS WITH ARDS

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Background: In animal models of ARDS, alteration of surfactant metabolism contributes to the pathophysiology of the disease. However, information is very limited in humans because lung tissue is not available and studies with radioactive isotopes are not feasible. Moreover, no data is available on the kinetics of the surfactant components during the disease process. In order to circumvent this problem we devised a novel method based on stable isotopes, which allows the study of surfactant metabolism without the hazard of radioactivity. Aim of this study was to elucidate the metabolism of disaturated-phosphatidylcholine (DSPC), the major surfactant component, in ARDS.

Method: DSPC half-life and DSPC apparent pool size were studied in 11 ARDS patients and in 8 adults with normal lungs requiring tracheostomy for neuromuscular conditions, following an intra-tracheal tracing dose of ^{13}C labeled dipalmitoyl-phosphatidylcholine. Kinetics data were obtained from the decay curves of the isotopic enrichment of the DSPC obtained from repeated tracheal aspirates measured by gas chromatography-mass spectrometry. Data were expressed as mean \pm SE.

Results: All but 3 ARDS decay curves were consistent with a mono-exponential decay model by regression analysis, whereas controls curves best fit turned out to be bi-exponential. Curve fitting regression coefficients were of $91.03 \pm 7.5\%$ (range 76.3-98.9%) and $90.1 \pm 6.1\%$ (range 84.7-96.1%) in ARDS and controls respectively. Surfactant DSPC half-life was significantly shorter (13.90 ± 1.99 vs. 34.94 ± 1.89 h $p=0.000$) and DSPC turnover significantly faster (1.48 ± 0.22 d^{-1} vs. 0.49 ± 0.03 d^{-1} , $p=0.001$) in ARDS than in controls.

Patients with ARDS had a significantly reduced apparent DSPC pool size (0.54 ± 0.08 in ARDS and 18.8 ± 6.02 mg/kg in controls, $p=0.03$).

In ARDS patients surfactant DSPC half-life was inversely and significantly correlated ($p=0.03$, $R^2=0.64$) with disease severity as expressed by the mean $\text{PaO}_2/\text{FiO}_2$ during the study period.

Half-life was markedly and significantly lower (13.90 ± 1.99 vs. 34.95 ± 1.89 h, $p=0.000$) and apparent pool size significantly smaller (0.54 ± 0.08 and 18.82 ± 6.02 mg/kg body weight, $p=0.03$) in ARDS than in controls. No difference was found in the tracheal aspirates DSPC amount ($p=0.2$). In ARDS, DSPC half-life directly and significantly correlated with the disease severity as expressed by $\text{PaO}_2/\text{FiO}_2$ ($p=0.03$).

Conclusion: This study describes for the first time the alterations of surfactant DSPC kinetics and lung surfactant apparent pool size in human adults with ARDS and in controls subjects with normal lungs. Our data indicate that increased surfactant DSPC catabolism occurs during the course of ARDS and patients have reduced amount of pulmonary surfactant. We provided for the first time in vivo in humans the evidence of that by labeling the endogenous surfactant of adult patients with ARDS and with normal lungs with a DSPC stable isotope tracer, administered intra-tracheally.

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