

Lung parenchyma and type II cell morphometrics: effect of surfactant treatment on preterm ventilated lamb lungs

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Pinkerton, Kent E., James F. Lewis, Evelyn D. Rider, Janice Peake, Waynea Chen, Amy K. Madl, Richard H. Luu, Machiko Ikegami, and Alan H. Jobe. Lung parenchyma and type II cell morphometrics: effect of surfactant treatment on preterm ventilated lamb lungs. *J. Appl. Physiol.* 77(4): 1953-1960, 1994.—The effect of exogenous surfactant treatment on lung and type II cell structure of ventilated lambs of 137-138 days gestational age was studied. Thirty-four lambs were delivered and randomized to control or 100 mg/kg of natural sheep surfactant treatment groups. Lungs from one group of lambs not treated with surfactant were fixed before ventilation, and the other animals were ventilated to maintain normal blood gas values for 3, 24, or 48 h. Morphometric assessment of the inflation-fixed lung parenchyma of ventilated lungs was compared with the architectural appearance of alveoli and alveolar ducts in the unventilated lungs. Mechanical ventilation resulted in distension of alveolar ducts accompanied by the shallowing and loss of well-defined alveoli and areas of atelectasis at 3 h. These abnormalities increased in severity after 24 and 48 h of ventilation. Surfactant treatment before ventilation significantly reduced the extent and degree of dilatation and concomitant atelectasis. The fraction of normal parenchyma was $38 \pm 7\%$ in untreated lambs vs. $64 \pm 6\%$ in treated lambs after 24 h of ventilation. After 48 h of ventilation, significant differences between control ($39 \pm 6\%$) and surfactant-treated ($55 \pm 6\%$) lambs were still evident. Alveolar type II cells contained $\sim 15\%$ lamellar bodies by volume. Neither surfactant treatment nor time of ventilation altered the volume density of lamellar bodies or other organelles, except for a decrease in glycogen from 8% in nonventilated lungs to 2.5% in lungs ventilated for 24 h. These findings indicate that a surfactant treatment at birth results in the maintenance of more normal parenchyma with less atelectasis during prolonged ventilation of the immature lung. There were no adverse effects of surfactant treatment on type II cells.

alveolar duct distension; atelectasis; bronchopulmonary dysplasia; lung injury; respiratory distress syndrome