**1750** ALVEOLAR PRESSURES DURING HIGH-FREQUENCY JET VENTILATION(HFJV) IN NORMAL AND SURFACTANT-DEFICIENT LUNGS. W.A.Carlo, R.L.Chatburn, J.P.Teeter,J.M.Fouke (Spon.by R.J.Martin), CWRU,Depts.Peds., Biomed.Engr., Cleve,OH

HFJV has been reported to reduce airway pressures during assisted ventilation in preterm infants. Nonetheless, augmented pressure transmission to alveoli has been observed at frequencies near resonance. We determined the effect of surfactant deficiency on airway to alveolar pressure transmission in 6 postmortem adult rabbit lungs (3 normal and 3 surfactant-deficient by multiple saline lavage) during both conventional ventilation (CV, f=30/min, rectangular wave) and HFJV (f=200/min, triangular wave). Alveolar pressure was measured via a piezoelectric transducer on the visceral pleura and communicating with the alveoli. Airway pressure was measured with a similar transducer and/or catheter, both inside the distal endotracheal tube. With each ventilator, measurements were obtained maintaining either peak inspiratory pressure(PIP 20-30cm$H_2O$), positive end expiratory pressure(PEEP 3-13cm$H_2O$) or $\Delta$P(PIP-PEEP 7-27cm$H_2O$) constant. During CV the ratios of alveolar to airway PIP, PEEP and $\Delta$P were always 1.0, while during HFJV they ranged from 0.9 to 1.1. Alveolar to airway pressure ratios were not affected by saline lavage and were independent of magnitude or combination of pressures used. We conclude that in this rabbit model of normal and surfactant-deficient lungs, airway pressures are transmitted to the alveoli with little distortion during HFJV at the frequencies employed. Thus, the previously reported reduction in airway pressures during HFJV may in fact portend decreased barotrauma at the alveolar level. Supported by ALA-Ohio

**●1751** RELEASE OF UPPER AIRWAY MUSCLE INHIBITION DURING AIRWAY OCCLUSION. W.A.Carlo, M.J.Miller, R.J.Martin, CWRU, Rainbow Babies&Child.Hosp.,Dept.Peds.,Cleve,OH

Control of upper airway(UA) muscles appears essential for maintenance of pharyngeal patency. Animal studies indicate that volume-related vagal inhibition during inspiration modulates UA muscles more than the diaphragm(DIA). To determine if preferential inhibition of UA muscles occurs in neonates during normal inspiration, we studied 9 infants (GA 30±3 wks, age 15±8 days, Wt 1.1±0.2 kg) by performing 9 (range 5-16) end expiratory nasal occlusions during sleep. We recorded UA EMG (via surface submental electrodes), surface DIA EMG, ventilation, esophageal and mask pressures.

Phasic inspiratory EMG occurred in 52±36% of unoccluded breaths and increased to 78±27%($p<.02$) in the first occluded effort. Peak UA EMG during unoccluded breathing was 58±28% of that during the first occluded effort ($p<.001$). This increase in UA EMG activity during occlusion was accompanied by an increase in time to peak UA EMG from 250±91 to 612±63 MS ($p<.001$), while the rate of rise did not change. In contrast, peak activity, time to peak, and rate of rise of DIA EMG were unchanged during the first occluded effort. Esophageal pressures were consistently transmitted to the nasal mask during occlusion, indicating UA patency. These data indicate that feedback associated with lung inflation inhibits UA EMG more than DIA EMG during normal breathing. Release of this inhibition during airway obstruction, with the concomitant increase in UA muscle activity, may be a major mechanism for maintenance of pharyngeal patency in preterm infants. Supported by NIH HL31173 and HL25830

**†1752** THE CELLULAR SITE OF INSULIN INHIBITION OF GLUCOCORTICOID-INDUCED LUNG MATURATION. Kathleen S. Carlson, Martin Post and Barry T.Smith, Harvard Medical School Department of Pediatrics, Boston.

The infant of the diabetic mother shows delayed lung maturation and available evidence suggests that both hyperinsulinemia and hyperglycemia may mediate this delay. In vitro studies have shown that insulin blocks cortisol stimulation of surfactant-associated phospholipid synthesis. Cortisol induces the synthesis of fibroblast-pneumonocyte factor (FPF) which in turn stimulates surfactant synthesis by alveolar type II cells. In the present study, we have examined the effects of insulin, cortisol and FPF on saturated phosphatidylcholine (SPC) synthesis by fetal type II cells alone and in the presence of fetal lung fibroblasts and the effects of insulin and cortisol upon the production of FPF activity by fetal lung fibroblasts. In fibroblast/type II cell cultures, cortisol stimulates ($^3$H)choline incorporation into SPC and this effect is blocked by insulin as well as by monoclonal antibodies directed against FPF. In type II cell cultures, cortisol is ineffective but SPC synthesis is stimulated by FPF. This stimulation is not inhibited by insulin. In contrast, preliminary studies suggest that insulin inhibits the elaboration of FPF activity by fetal lung fibroblasts exposed to cortisol.

These observations confirm the ability of insulin to block cortisol induction of lung maturation and suggest that this action is exerted on the fetal lung mesenchyme.

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**1753** ARTERIAL DEVELOPMENT IN PULMONARY HYPOPLASIA Suchiung Chen & Daphne DeMello, (Spon. by J. Monteleone) St. Louis Univ., Dept. of Pediatrics, St. Louis.

Morphometric studies of the lungs were performed at autopsy in 17 infants with pulmonary hypoplasia (PH). The pulmonary arteries were injected with a Barium gelatin suspension and the tracheo-bronchial tree was perfused with formaldehyde. 14 infants had other anomalies in addition to PH. Radial alveolar counts were reduced in all patients. Arterial changes varied from mild to moderate and included peripheral extension of muscles and normal or increased wall thickness. (Table) Alveolar-arterial ratios were within normal limits. Pulmonary arterial development is abnormal in PH. Clinical outcome may be dependent on the severity of arterial changes.

| | | Severity of Arterial Changes | | |
|---|---|---|---|---|
| Etiology | Total | A | B early | B late |
| Renal anomaly or Potter's syndrome | 7 | 2 | 4 | 1 |
| Diaphragmatic hernia | 3 | 1 | 0 | 2 |
| Primary PH | 3 | 1 | 0 | 2 |
| Agenesis of one lung | 1 | 0 | 0 | 1 |
| Others | 3 | 1 | 0 | 2 |

A=Abnormal muscular extension ± wall thickness <1.5 X normal.
B early=Peripheral muscular extension, wall thickness 1.5 X-2X normal.
B late=Peripheral muscular extension, wall thickness >2X normal, and tendency to reduced artery size

**1754** LUNG HYPOPLASIA IN FETUSES OF RATS EXPOSED TO CIGARETTE SMOKE: A MORPHOMETRIC ANALYSIS. Margaret H. Collins, Adrien C. Moessinger, Jerome Kleinerman, Jorge A. Bassi, Pedro Rosso, Alex Collins, L. Stanley James, William A. Blanc. Depts. of Path., Ped. and Inst. of Human Nutrition, Columbia University and the Mt. Sinai School of Medicine, N.Y., N.Y.

Since most mothers who smoke cigarettes may have smoked when pregnant, it is difficult to distinguish between pre- and postnatal effects of maternal smoking on their children's lungs. Using an animal model we demonstrated earlier that maternal smoking leads to a selective pattern of fetal growth retardation with predominant impact on the lungs, with significantly reduced lung weight, lung/body weight ratio and total lung DNA content. (Ped. Res. 17,4:138A, 1983). Using the same rat model we now present a morphometric analysis of the lungs of 4 experimental and 3 control term fetuses derived from a total of 6 litters. Results: Volumes of lungs fixed and inflated at 15 cm $H_2O$ pressure were less in the experimental group, 0.28 vs 0.33 ml, $p<.005$. The total number of saccules was reduced, $3.2 \times 10^6$ vs $5.5 \times 10^6$, $p<.005$, and average saccular volume was increased, $35 \times 10^{-9}$ vs $21 \times 10^{-9}$ml, $p<.025$. The internal surface area was decreased, 161 vs 198 $cm^2$, $p<.001$. Total length of elastic tissue was reduced, 224 vs 354 M, $p<.05$, but length per unit area and per unit volume were not significantly different. We conclude that the lungs of fetuses of smoke-exposed dams are hypoplastic, have less surface available for gas exchange and have enlarged saccules. It is possible that the impaired lung growth noted in children of smokers may have started in utero.

**1755** EFFECT OF RACEMIC EPINEPHRINE ON VENTILATORY FUNCTION IN THE NEONATE POST EXTUBATION. Sherry E. Courtney, John P. Wachtl, John F. Hopson, Roger M. Siervogel, (Spon. by M. Kogut). Wright State University, Department of Pediatrics, Children's Medical Center, Dayton, Ohio.

Nebulized racemic epinephrine is commonly used to improve ventilatory function in the newborn post extubation. To evaluate this therapy, 44 infants intubated for >3 days [mean 17.2±16.1 days (S.D.)] were studied. Infants were randomized to receive racemic epinephrine by nebulization immediately post extubation or to receive only warmed, humidified oxygen. Measurements of air flow ($\dot{V}$), esophageal pressure (Pes), tidal volume ($V_T$), respiratory rate (RR), and heart rate (HR) were made before treatment (immediately post extubation) and every 10 minutes for one hour. Changes from baseline values were calculated for each time period and analysis of variance of these variables for treatment, sex, and time main effects and their interactions, with appropriate adjustment for covariables, were performed. There were no significant time effects or interactions. The table presents mean ±1 S.D. changes over time for each treatment-sex group.

| Sex | Rx | N | ΔRR breath/min | ΔHR beat/min | Δ$\dot{V}$ L/min | ΔPes cm$H_2O$ | Δ$V_T$/kg ml/kg |
|---|---|---|---|---|---|---|---|
| M | + | 10 | - 4.2±22 | - 2.2± 9 | -.07±.4 | -.28±0.9 | .42±3 |
| M | - | 14 | -10.9±15* | - 6.6±16 | -.17±.5 | -.70±1.4 | .09±3 |
| F | + | 12 | 8.9±19 | 8.7±11* | -.16±.6 | -.21±0.9 | -.99±5 |
| F | - | 8 | 2.0±15 | -13.3±10** | -.20±.4 | -.01±0.9 | -.21±1 |

* $.01 < p < .05$ **$p < .01$

This study provides no evidence that using nebulized racemic epinephrine in infants post extubation improves ventilatory function.