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ENHANCEMENT OF FETAL LUNG SURFACTANT PRODUCTION BY AMINOPHYLLINE. A. Sevanian, C. Gilden, S.A. Kaplan & C.T. Barrett. Univ. of Calif. at Los Angeles, Dept. of Pediatrics.

Aminophylline (A) administration to pregnant rabbits prior to premature delivery was previously shown to enhance fetal survival. We have now studied effects of maternally administered A on incorporation of labeled glucose (G) and palmitate (P) into phospholipids in rabbit fetal lung slices. Mean incorporation ± SD for 10 paired litters, A treated and controls (C) was as follows:

		PC	SPC	PG	PI	Sph
C	glucose	32.4± 3.7	12.6±0.9	28.4±3.5	22.8±1.4	24.2±2.2
	palmitate	204.0±17.3	89.0±6.0	10.8±2.4	2.3±0.52	9.4±2.4
AM	glucose	33.7± 3.9	14.6±1.6	31.8±3.7	33.4±4.2	30.4±2.3
	palmitate	201.0±19.0	95.0±7.1	12.1±0.7	2.9±0.14	8.5±2.2

Significant differences were found for saturated phosphatidylcholine (SPC) and phosphatidylinositol (PI). Precursor incorporation into phosphatidylglycerol (PG) was not significantly higher in the A group but PG and PI content in μmoles/g. lung was greater after 3 days of treatment (2.27 ± 0.40 vs 1.67 ± 0.36) and (0.26 ± 0.035 vs 0.23 ± 0.011) respectively. Glycogen content in mg./g. lung and specific activity in nmoles G incorporated/mg. glycogen was reduced in the A group, (2.63 ± 0.94 vs 3.97 ± 0.14) and (38.7 ± 8.7 vs 48.8 ± 5.0). Analysis of triglyceride (TG) and free fatty acid (FA) pool sizes showed a lower TG and higher FA content in A treated tissue suggesting increased lipolysis. The results further support the role of A in enhancing synthesis of fetal lung surfactant.

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PHOSPHATIDYLCHOLINE SECRETION FROM A CELL LINE (A549) WHICH RESEMBLES TYPE II PNEUMOCYTES. Donald L. Shapiro and Jose L. Munoz. (Spon. by J.B. Warshaw, Yale University School of Medicine, Department of Pediatrics, New Haven, Connecticut.

The A549 cell line resembles Type II pneumocytes morphologically, synthesizes disaturated phosphatidylcholine and stores it in lamellar bodies. The phospholipid secreting properties of this cell line were studied. The cells were pulsed with either (^{32}P)- or (^{3}H)-choline and release of phospholipid into the medium measured. In the absence of a stimulating agent, small amounts of labelled phospholipid were recoverable in the medium. However, removal of serum from the medium caused a marked (10 fold after 2 hours) reduction in the rate of phospholipid release, probably due to the elimination of exchange between cellular membranes and serum lipoprotein. Albumin can mimic the effect of serum. The calcium ionophore A23187 stimulates exocytosis in many secretory systems and it produced a 30 fold increase in the rate of secretion of phosphatidylcholine (45% disaturated) from A549 cells. The effect was inhibited by the removal of calcium or the addition of EDTA to the medium. Incubation of cells with some potential physiologic secretagogues, including isoproterenol, norepinephrine, carbamyl choline, and dopamine did not produce a significant increase in the rate of phospholipid secretion. The A549 cell line secretes phosphatidylcholine by calcium dependent exocytosis and may be a useful experimental system for elucidating factors which regulate surfactant secretion from Type II pneumocytes.

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EFFECT OF CYSTIC FIBROSIS SERUM ON RAT LUNG EPITHELIAL CELLS IN CULTURE. Marcia J. Sharp, Robert C.Borer,Jr., William F. Howatt, William H.J.Douglas, Guy E.Ringler, Univ. of Michigan Sch. of Med., Dept. of Pediatrics, Ann Arbor, and W. Alton Jones Cell Sci. Center, Lake Placid, N.Y.

An in vitro system for evaluating the toxicity of serum from cystic fibrosis (CF) patients is reported. Rat lung epithelial cells were incubated for 18 hours in medium containing varying concentrations of human serum (HS) from CF patients and patients without cystic fibrosis (non-CF). Twenty-four assays were performed for 4 concentrations of each HS. Attachment efficiency (AE), defined as the number of cells attached to the culture surface divided by the number of cells dispensed per culture, was determined for each concentration of HS. Attachment efficiency was always greater when no human serum was present. As the percentage of serum increased, the AE decreased in all cases.

Because the AE varied from day to day, the ratio (RAE) of the AE for 0% HS to the AE for 2% HS was calculated for each serum sample. The RAE value was reproducible within 0.07 over a four-week interval for individual serum samples. The higher the RAE value, the more toxic the serum.

Patients	Number	RAE		
		Mean ± SD	Range	Median
CF	16	21.6 ± 31.2	1.4 - 107.0	6.9
Non-CF	17	3.5 ± 2.8	1.3 - 12.3	2.9

There is a significant difference ($p < 0.05$) in the two populations of patients. The serum from the CF patients was more toxic to rat lung epithelial cells than serum from non-CF patients.

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MAXIMUM INSPIRATORY FORCE IN PREDICTING SUCCESSFUL INFANT EXTUBATION. David Shoults, Thomas A. Clarke, Frank L. Mannino, Jonathan Benumof (Sponsored by Louis Gluck), Univ. of Calif., San Diego, Dept. of Pediatrics and Anesthesia, La Jolla, Ca.

Maximum inspiratory force (MIF) in adults correlates well with a patient's ability to be weaned from mechanical ventilation. The relationships among MIF, $Paco_2$, respiratory rate (RR), & patient outcome were studied in 20 neonates receiving ventilatory support (BABYbird^R). A Boehringer inspiratory force meter was used to obtain MIF daily throughout each patient's course. At each measurement the patient was given 3-4 trials to achieve MIF consisting of 15 seconds of airway occlusion or 12 inspiratory attempts. An attempt was made to occlude the airway at functional residual capacity (FRC). Mean values were:

G.A. (wk)	MIF(cmH_2O)	$Paco_2$(torr)	RR
All (N=20)	32±14	43±7	52±10
<30 (N=7)	18±5	39±5	50±10
≥30 (N=13)	40±11	46±7	54±11

Two variable regressions with a level of significance of $p<0.05$ showed: 1) MIF did not correlate with $Paco_2$ or RR in the entire group or when the patients were compared by gestational age. 2) MIF did not correlate with reintubation (N=4, mean 29±13cmH_2O) vs no reintubation (N=16, mean 33±15cmH_2O). This lack of correlation may be due to the technical difficulties of occluding the infant airway exactly at FRC. MIF is an index of respiratory muscle function & may not detect infants with apnea or increased secretions after extubation. We conclude that MIF does not correlate well with ability to wean neonates from mechanical ventilation.

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PERSISTENT FETAL CIRCULATION IN NEONATES WITH DIAPHRAGMATIC HERNIA. Bijan Siassi, Luis A. Cabal, Ronald N. Goldberg, Udayakumar P. Devaskar, Carolyn Plajstek, Joan E. Hodgman. Univ. of So. Calif. Sch. of Medicine, LAC-USC Medical Center, Department of Pediatrics.

In spite of advances in neonatal surgery, the mortality rate from diaphragmatic hernia (DH) remains high. Infants with the early onset of symptoms are at greatest risk and die of hypoxia in spite of successful repair of the defect. The objective of this study was to determine the incidence and to identify factors leading to hypoxemia and death in these infants. Of 21 infants born with DH in our hospital during the last 7 years, 13 had respiratory distress from birth. Nine (70%) of these 13 infants had persistent fetal circulation (PFC) which terminated in death in 6 (46%) infants. PFC was characterized by elevated right atrial pressure, hypoxemia in the descending aorta in spite of inhalation of 100% oxygen and evidence for right-to-left shunt at atrial or ductal levels. In patients who died, progressive hypoxemia and metabolic acidosis were accompanied by severe peripheral vasoconstriction, poor skin perfusion and systemic hypertension. In this study, PFC was the major cause of death in infants with DH. PFC occurred commonly and exclusively in infants whose symptoms were present at birth. Unless PFC is recognized early and reversed by vigorous treatment, the infants will die as a result of progressive hypoxemia and metabolic acidosis.

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THE PERFORMANCE OF NEONATAL RESPIRATORS. G.Simbruner, G.Gregory, Univ.Calif.San Francisco.

We tested 5 neonatal respirators $\bar{c}$ & $\bar{s}$ a pressure plateau & PEEP for the ability to deliver a preset tidal volume (VT) & to allow rapid, complete exhalation. We simulated 9 relevant states of lung mechanics (ML) from C=4 (compliance in ml/cm H2O), R=50 (resistance in cm H2O/l/sec) to C=0.6, R=500. We also set a VT with known ML& measured the decrease in VT $\bar{c}$ deteriorating C&R and $\bar{c}$ a "tracheal" leak. Table 1 gives data from extreme situations. The %increase in expiratory time constant (tex), $\bar{c}$ the respirator attached describes the ventilators' impact on exhalation (col.2&5). The minute ventilation (V) possible $\bar{c}$ normal & abnormal ML are in col.3&6. $\dot{V}/\bar{p}$ alv for ventilators 1-3 is<50% that $\bar{c}$ 4&5, due to R&C of the respirators. The differences are less $\bar{c}$ the "sick" lung because ML now predominate. When ML change from C=4, R=50 to C=0.6, R=500 and an air leak occurs, VT is reduced>60% in all ventilators. Only Bourns LS104 & Prototype SI75 produced an alveolar pressure plateau in poorly compliant, high resistance lung. We conclude that these respirators 1) inadequately compensate for changes in ML, 2) increase elastic &resistive load considerably when used in IMV mode, 3) don't compensate for gas leaks, 4) don't allow prediction of VT $\bar{s}$ knowledge of lung or respirator mechanics, &5) are less dissimilar $\bar{c}$ bad ML.

Ventilator	30ml VT, C=4, R=50 %tex	$\dot{V}$	$\dot{V}/\bar{p}$ alv	15ml VT, C=0.6, R=500 %tex	$\dot{V}$	$\dot{V}/\bar{p}$ alv	%VT delivered / no leak	leak
1 Baby-bird	48	847	405	10	400	57	33	23
2 BournsBP200	39	1051	259	8	453	45	30	24
3 Veriflow	46	884	413	12	426	66	30	23
4 BournsLS104	15	1206	628	1	478	74	42	32
5 PrototypeSI	6	1249	735	0	512	75	24	21