●1786 HYPEROXIC LUNG INJURY: PULMONARY PROSTAGLANDIN (PG) INCREASES PRECEDE MORPHOLOGIC CHANGES. Joseph R. Hageman, Stephen Lee, Michael Cobb, Lewis Smith, Lauren Pachman, and Carl E. Hunt. Northwestern University, Departments of Pediatrics and Medicine, Chicago, IL.

To assess the role of PGs in the early development of hyperoxic lung injury, 11 adult rabbits with chronically implanted arterial and venous catheters were exposed to >95% O_2 or air for 24 hours. At 24 hours, PaO_2 was 524 ± 41 (SD) and 92 ± 10 Torr in the hyperoxic and control rabbits. PG E_2, PG 6-keto $F_{1\alpha}$ and thromboxane (TX) B_2 levels (pg/ml) were measured by RIA in plasma and in bronchoalveolar lavage (BAL) supernatant. Protein (P) was measured in serum and BAL; BAL WBC and % PMN were also measured. Hyperoxic exposure for only 24 hours did not cause a significant increase in BAL P (Table, Mean ± SD) or any light or electron microscopic changes. However, BAL % PMN and the BAL:plasma PG 6-keto $F_{1\alpha}$ ratio both increased significantly. The increases in BAL:plasma PG E_2 and TX B_2 were not significant. In summary, increased PG 6-keto $F_{1\alpha}$ may be an early marker of hyperoxic lung injury. In addition to providing further support for a relationship between PGs and the development of hyperoxic lung injury, these results suggest a potential preventive role for PG inhibitors.

GROUP	BAL PMN (%)	BAL P (ug/ml)	BAL:Plasma (pg/ml) PG E2	PG 6-keto $F_{1\alpha}$	TX B_2
CONTROLS	0.6 ± 0.7	60 ± 30	0.4 ± 0.1	0.4 ± 0.2	0.6 ± 0.4
HYPEROXIC	3.6 ± 1.7	90 ± 50	1.5 ± 1.8	1.0 ± 0.5	1.4 ± 1.5
p	<.05	NS	NS	.025	NS

†1787 SURFACE ACTIVE MATERIAL (SAM) AND COMPLIANCE CHANGES DURING RECOVERY FROM EXPERIMENTAL HYALINE MEMBRANE DISEASE (HMD)[1]. J.C. Jackson[2], S. Palmer, T.A. Standaert, J. Murphy, W.E. Truog, D.E. Woodrum, R.J. Badura, G.K. Sorensen, J.F. Watchko, W.A. Hodson. Dept. of Pediatrics, Univ. of Washington, Seattle, WA.

It is not known whether recovery from HMD begins in spite of a deficiency of SAM or only after return to some critical value. Eight of 12 M. nemestrina primates delivered at 80% of normal gestation developed HMD and were sacrificed at defined stages in their recovery. Postmortem deflation stability (%total lung capacity [TLC] at P=10cm H_2O pressure) and diphosphatidylcholine (DPC) quantities in unlavaged lung tissue and in bronchoalveolar lavage were compared to controls as well as four healthy term 3-4 week old infants.

	%TLC at P=10	Tissue DPC mg/gm dry lung	Lavage DPC mg/gm dry lung
HMD no recovery	57.3±11.0	15.0±3.5	0.59±0.28
HMD early recovery	82.0±2.8	15.9	2.2
HMD late recovery	85.7±3.1	30.4±4.0	10.2±3.2
Healthy control	87.8±5.4	29.7±4.6	15.0±8.9
3-4 wk old term	78.0±5.0	18.0±1.3	2.9±0.48

We conclude that 1) the disparity between tissue and lavage DPC quantities in animals with HMD suggests a problem in release of SAM rather than tissue production and 2) clinical recovery and improvement in deflation stability occur despite DPC levels that are quite low compared to control but similar to older infants.

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●1788 REUTILIZATION (RU) OF SURFACTANT (NS) PHOSPHATIDYLCHOLINE (PC) IN ADULT RABBITS (R). H.C. Jacobs, M. Ikegami, A.H. Jobe, D. Berry, Dept. of Pediatrics, Harbor-UCLA Medical Center, UCLA School of Medicine, Torrance, CA

Several studies have demonstrated RU of NS PC in developing and adult R. The magnitude of RU in adult R has not been determined. We injected 87 1 kg R with two solutions simultaneously. [^{14}C]palmitate was given IV and a solution of [^{3}H]choline labeled NS plus [^{32}P]dipalmitoylPC (DPC) was injected intratracheally (IT). R were sacrificed from 10 min to 72 hrs after injection. From each R we collected a complete alveolar wash (AW) and isolated a lamellar body (LB) fraction. We measured total [^{3}H]PC and [^{32}P]PC recovered in the AW and [^{14}C]PC specific activity (SA) in the AW and in LB. From curves of [^{14}C]PC SA in the LB and the AW vs time, we calculated the flux of PC from the LB into the AW (PC flux) and the turnover times (T_t) for alveolar PC (T_t =total AW PC/PC flux). A computer generated equation describing the total AW [^{3}H]PC vs time was obtained and used to independently calculate the PC flux, the T_t, the % RU of NS PC and the LB PC pool size. The results are shown in the table.

	T_t	PC Flux	% RU	Total LB PC/Total AW PC
IV	6.88 h	1.64 µmol PC/h	--	--
IT	6.18 h	1.82 µmol PC/h	31%	.92

Also, the ratio of [^{3}H]PC to [^{32}P]PC in the AW did not change with time. We concluded that 1) IT and IV labeling gave comparable results. 2) IT NS and the added DPC behaved metabolically like endogenous NS. 3) That RU of PC in adult R (31%) is less than that of developing R (>90%).

●1789 SEQUENTIAL CHANGES IN ALVEOLAR-CAPILLARY MEMBRANE PERMEABILITY IN HYALINE MEMBRANE DISEASE (HMD). Ann L. Jefferies, Geoffrey Coates, Hugh M. O'Brodovich (spon. by J.C. Sinclair) McMaster University, Depts. of Pediatrics and Radiology, Hamilton, Ontario, Canada L8N 3Z5

Because HMD is complicated by increased lung water and protein content, alveolar-capillary membrane permeability may be increased. Using aerosolized ^{99m}technetium-diethylene triamine penta acetate (Tc-DTPA) as previously described (ARRD 127(4):299,1983), we assessed pulmonary epithelial permeability on 28 occasions in 13 intubated infants, 28 to 36 weeks gestation, with HMD. The lungs were insufflated with 10-15 µCi of Tc-DTPA and counts over the upper right chest recorded for 30 minutes with a NaI scintillation probe. Pulmonary half-life ($T_{½}$) of Tc-DTPA was calculated from the slope of the clearance curve. Infants were studied as soon after intubation as possible and 2-3 times subsequently until extubation. In all 11 studies done within 72 hours of birth, the clearance curve was biphasic with a rapid phase $T_{½}$ of 1.6 ± 0.2 min (mean ± SE). Normal adults have a monophasic curve with $T_{½}$ of 45-80 minutes. In 7 of the 9 studies done just prior to extubation on infants who recovered (mean age 6 days), the curve had changed to monophasic with $T_{½}$ of 48.1 ± 8.0 min. Two infants remained O_2 and ventilator dependent and had persistent biphasic curves past 1 week of age with a rapid phase $T_{½}$ of 1.4 ± 0.6 min. We conclude that pulmonary clearance of Tc-DTPA in infants with HMD in the first 3 days of life is rapid, suggesting increased permeability to small solutes, and as HMD resolves, permeability approaches normal adult values. Persistent lung disease is associated with persistent rapid clearance.

●1790 INCREASED LUNG PROTEIN PERMEABILITY OF PREMATURELY DELIVERED AND VENTILATED LAMBS. A.H. Jobe, M. Ikegami, H.C. Jacobs, D. Berry, Dept. of Pediatrics, Harbor-UCLA Medical Center, UCLA School of Medicine, Torrance, CA.

Groups of 8 lambs were delivered at 122, 135 or 146 days (d) gestational age (GA) and ventilated. Lambs at 122 d were treated with natural sheep surfactant (NS). Mean blood gas values and ventilator settings were similar for all groups. The lambs at 146 d required lower peak inspiratory pressures (PIP) to normalize pCO_2 values relative to the other lambs (15 vs 24 cm H_2O). To control for this variable, 4 lambs at 146 d were ventilated at 25 cm H_2O PIP with added CO_2 to normalize pCO_2. The exit from the airways of ^{125}I-albumin added to fetal lung fluid at delivery, the entrance into the airways of ^{131}I-albumin given by vascular injection, the protein in alveolar washes (AW), and % recovery of labeled albumin in lung tissue (corrected for blood volume) were measured after 3 hr of ventilation.

	% Recovery of Injected Dose in AW (M+SE) 122	135	146	146+CO_2
^{125}I-albumin	50.2±1.6	62.9±4.4	78.9±2.9	72±4
^{131}I-albumin	3.3±4	2.3±0.3	0.6±0.1	0.7±0.1
Mg Protein AW/kg	140±14	97±9	73±7	52±3

The amount of ^{125}I that left the alveoli increased, the amount of ^{131}I that entered the alveoli increased, and total protein increased as GA decreased (p values <0.05, ANOVA). There is an increasing protein leak with decreasing GA in ventilated lambs that is independent of NS treatment or the PIP required to ventilate the lambs.

1791 LIMITS OF HIGH FREQUENCY JET VENTILATION IN SMALL SUBJECTS. Martin Keszler, Blanca Molina, K.N. SivaSubramanian, (Spon. by P.L. Calcagno). Dept. of Pediatrics Georgetown Univ. Med. Ctr., Washington, D.C.

To define limits of injector size/internal compressible volume (ICV) of the jet tubing in small subjects, we studied anesthetized paralyzed cats using the MK-800 jet ventilator & noncompliant tubing with ICV of 14 ml. FIO_2 of 1.0 & 30% duty cycle remained constant. In part I the injector size was varied from #12,14,16 to 18 (2.16-1.06mm) at rates of 150 & 300/min with normal and noncompliant lungs. The driving pressure was adjusted to keep a constant mean airway pressure (MAP) for each set of conditions. In part II the ICV was ↑ from baseline(B) to 1.5B, 2B and 3B through the same sequence as in part I, using #14 & #16 injectors. Tracheal pressure tracing was recorded. Despite constant MAP, PCO_2 rose with ↓ injector diameter though with normal lungs at 150/min PCO_2 was normal even with the smallest injector (#18). Increasing ICV up to 3B had no effect with #14 injector or with normal lungs. With #16 injector and stiff lungs, PCO_2 rose as ICV ↑. *p < 0.05

	(I) 12	14	16	18	(II) B	1.5B	2B	3B
Normal Lung - 150	29	26	33	42*	26	25	28	27
Normal Lung - 300	30	31	45	62*	41	40	38	42
Stiff Lung - 150	25	27	32	47*	27	31	38	44*
Stiff Lung - 300	24	29	37	62*	39	45	54	56*

$\bar{x}$ PCO_2 with different injectors (I) & ICV with #16 injector (II)

When an unfavorable relationship exists between injector size, driving pressure & ICV excessive compression of gas in the patient circuit results in loss of pulsatility of gas flow & inadvertent PEEP leading to CO_2 retention.