1653A EFFECT OF ABDOMINAL LOADING ON DIAPHRAGMATIC ACTIVITY IN POSTNATAL RHESUS MONKEYS. James Fewell and Paul Johnson, Nuffield Institute for Medical Research, University of Oxford, U.K. (sponsored by Ian Gross)

Tonic diaphragmatic activity (electrical activity at end-expiration) measured transcutaneously has been reported to occur in infants and adults during quiet sleep and to increase during abdominal loading (J Appl Physiol 47:279,1979). However, Harding et al., showed that tonic activity in the peripheral diaphragm of lambs was independent of phrenic innervation and concluded that it resulted from contamination with respiratory and postural activities of adjacent muscles (J Physiol 292:57P,1979). We sought to determine if abdominal loading altered diaphragmatic activity in five monkeys (14 to 34 days of age) during quiet sleep or during sedation with Sernylan. Respiratory events were timed from the esophageal pressure tracing. Squeezing the abdomen (10 to 40 mmHg pressure) increased phasic diaphragmatic activity which resulted from: 1) greater activity during T_i, 2) lengthening of T_i (increased by 140±60 msec at 40 mmHg compared to 0 mmHg) and 3) increased post-inspiratory activity (increased by 93±13 msec at 40 mmHg compared to 0 mmHg). Although abdominal loading increased post-inspiratory activity, tonic activity did not occur at any time. As in lambs (J Physiol 292:22P,1979), phasic activity recorded from different parts of the diaphragm was asynchronous.

We conclude that abdominal loading increases phasic diaphragmatic activity but does not elicit tonic diaphragmatic activity in monkeys. (Supported by HL 07159 and Wellcome Trust 9594-1.5)

1654 ISOLATION OF ALVEOLAR TYPE II CELLS WITH A LASER FLOW CYTOMETER. Jacob N. Finkelstein, James F. Leary, Robert H. Notter and Donald L. Shapiro. U. of Roch. School of Med., Strong Mem. Hosp., Dept. of Peds., Roch., NY

Isolation of relatively pure populations of alveolar type II epithelial cells has previously only been possible by density gradient centrifugation techniques which exploit the low buoyant density conferred on such cells by lung surfactant containing lamellar bodies. We have used a multiparameter laser flow cytometer (cell sorter) to obtain similar populations of lamellar body containing cells from single cell suspensions made from rabbit lungs subjected to enzymatic dissociation by trypsin and elastase. The lamellar body cells are sorted on the basis of two parameters: low angle light scatter, and green fluorescence from the lipid seeking probe phosphine-3R. Cells do not separate well on the sorter when either of these two parameters is used alone. For example, alveolar macrophages scatter light in an overlapping range with lamellar body cells, and various kinds of cell debris stain with phosphine-3R in the same intensity region as viable cells with lamellar bodies. However, when both light scatter and fluorescence are considered simultaneously, the multiparameter cell sorter gives a highly purified population of lamellar body cells in a regime of high light scatter and high fluorescence. Presently we sort at a rate slightly less than 10^7 lamellar body cells per hour, certainly less than obtainable with gradient separation methods. However, the multiparameter cell sorter has the advantage of near absolute purity of type II cell populations obtained, and has the potential to isolate developing lung cells with few lamellar bodies which would not readily segregate by buoyant density.

● 1655 THE ADVERSE EFFECT OF HYPOCALORIC UNDERNUTRITION ON OXYGEN TOLERANCE IN NEWBORN RATS. Lee Frank (Spon. by Eduardo Bancalari) V.A. Hospital and Univ. of Miami Sch. of Medicine, Pulmonary Division, Miami, FL

Because newborn infants who require intensive respiratory support and high O_2 therapy are often less than adequately nourished during the early days of life, we tested the effect of hypocaloric undernutrition on newborn rat pups exposed to hyperoxia. Rat pups were randomized into groups of 11/dam (normally-nourished) (NN) or 18/dam (undernourished)(UN) and placed in >95% O_2 (or 21% O_2) for the Ist 7 days of life. Dams were switched daily to prevent O_2 toxicity in the nurturing adult rats. In each of 4 experiments the UN pups tolerated hyperoxia more poorly than the NN pups. Composite survival rates at 7 days in O_2 were: 47/108 (44%) (UN) vs. 56/77 (73%)(NN)($p<0.005$). The UN pups had significantly reduced body wts and lung wts, but the lung wt/body wt ratios were normal (0.86 vs. 0.83). Lung maturation was markedly impaired by O_2 exposure in both nutritional groups - alveoli per high power field = 11.1 ± 2.3 (NN in air) vs. 3.5 ± 0.7 (NN in O_2) (68% inhibition); 11.4 ± 2.6 (UN in air) vs. 4.2 ± 0.7 (UN in O_2) (64% inhibition). There were essentially equivalent increases in the protective lung antioxidant enzyme responses to hyperoxia in the NN and UN pups, respectively: superoxide dismutase (+80%, +85%); catalase (+90%, +75%); glutathione peroxidase (+275%, +230%); G-6-PD (+200%, +240%). Thus, tolerance to prolonged high O_2 treatment is definitely impaired in UN pups; but the mechanism(s) for compromised tolerance in hypocaloric undernourished newborns needs further explication. (Supported in part by V.A.H. Research funds and NIH grant HL26029).

● 1656 IMPROVEMENT IN PULMONARY INTERSTITIAL EMPHYSEMA WITH HIGH FREQUENCY VENTILATION. I.D. Frantz, A.R. Stark, J. Werthammer, Department of Pediatrics, Harvard Medical School, Boston, MA.

We have used high frequency ventilation (8-12 Hz or 480-720 cycles/min) to treat five infants with severe pulmonary interstitial emphysema (PIE). All infants were recovering from severe respiratory distress syndrome when X-ray evidence of PIE and blood gas deterioration were noted. The infants had gestational ages of 28-32 weeks, birthweights of 1.0-1.7 kg, and were treated starting at 3-12 days of age. Four of the infants were maintained on the high frequency ventilator for approximately 48 hours, and one for 26 days. FIO_2 averaged 0.74 and peak inspiratory pressure 38 cm H_2O during conventional ventilation immediately prior to high frequency ventilation. All infants demonstrated prompt improvement in blood gases reaching an average 60 torr increase in PO_2 and a 20 torr decrease in PCO_2 within one hour. Peak pressure measured in the trachea near the carina fell from 38 to 20 cm H_2O. All infants showed resolution of chest X-ray evidence of PIE. Attempts to reinstitute conventional respirator therapy resulted in reoccurrence of PIE in two cases. Two infants weaned rapidly from all respiratory support, one weaned slowly and two died after two days of initial improvement. We conclude that because of the low airway pressures required, high frequency ventilation can be life saving in the treatment of pulmonary interstitial emphysema.

1657 CHARACTERIZATION OF RESPIRATORY MUCUS GLYCOPROTEINS FROM CYSTIC FIBROSIS PATIENTS' SPUTA. Ralph C. Frates, Jr. and James Etchison. (Spon. by Raymond D. Adelman). University of California Davis, Sacramento Medical Center and Primate Center. Department of Pediatrics.

High molecular weight mucus glycoproteins have been isolated intact from whole sputum from a patient with cystic fibrosis. Complete stabilization of whole sputum was effected with 6 M Urea + 1% sodium dodecyl sulfate (SDS) in the presence of 10 mM dithiothreitol (DTT), protease inhibitors, ribonuclease, and deoxyribonuclease. After carboxylmethylation of sulfhydryl groups, the solubilized sputum was fractionated on a 5.0 x 150 cm column of Sepharose CL-4B in the presence of 6 M Urea. Mucus glycoproteins (i.e. not protease-treated) prepared in this manner were water soluble and formed clear, highly viscous solutions even though disulfide interactions were precluded by carboxymethylation of sulfphydryl groups. Studies are under way to characterize both the polypeptide(s) and digosaccharide moieties of these glycoproteins.

● 1658 REGIONAL AND LOBAR PULMONARY BLOOD FLOW WITH HIGH FREQUENCY VENTILATION. Frank R. Gioia, Gregory Rinehart, Richard J. Traystman and Mark C. Rogers. The Johns Hopkins Medical Institutions, Departments of Pediatrics and Anesthesiology/Critical Care Medicine, Baltimore, MD 21205

We compared regional and lobar pulmonary blood flow in conventional mechanical ventilation (CV) and high frequency ventilation (HFV) to determine whether changes occur in the distribution of lung perfusion. Fourteen supine anesthetized, paralyzed dogs were ventilated with room air using CV and HFV (tidal volume=2.5 ml/kg, frequency=10 Hz.) Blood gases, pulmonary and systemic arterial pressures, and cardiac output were allowed to reach a steady state, at which time radioactive microspheres were injected. Arterial blood gases with CV showed PO_2=94.3 ± 2.2 torr (mean ± S.E.), PCO_2=34.5 ± 1.5 torr, and pH=7.35 ± .02. These values remained unchanged with HFV. Comparison of systemic and pulmonary arterial pressures, cardiac output and venous admixture showed no significant differences. In 11 dogs, tissue samples from apical, nondependent, and dependent areas of the lungs were analyzed for changes in blood flow. Regional pulmonary blood flow for apical, nondependent and dependent regions using CV were 44.82±7.06, 44.89±5.04, and 94.45±6.49 ml/min/gm.dry wt, respectively. The corresponding flows using HFV were 44.27±6.69, 46.47±4.47, and 93.83 ±6.38 ml/min/gm dry wt. These differences were not significant. In the remaining 3 animals, each lobe was analyzed for changes in total lobar blood flow under conditions of CV and HFV, and total lobar blood flows were not different. We conclude that HFV does not produce significant changes in regional or lobar distribution of pulmonary blood flow, or in overall hemodynamics.