1671

PULMONARY ENDOCRINE-LIKE CELLS IN HYALINE MEMBRANE

DISEASE AND BRONCHOPULMONARY DYSPLASIA. Dana E.

Johnson, James E. Lock, Robert P. Elde, and Theodore R. Thompson. (Spon. by William Krivit) Univ. of Minn. Medical School, Depts. Pediatrics and Anatomy, Minneapolis, MN.

Endocrine-like cells (K-cells) are known to be present individually and in groups in the neonatal and fetal lung. These cells contain serotonin and at least one peptide, bombesin; both influence vaso- and bronchomotor tone. Though these cells are found in greatest number during the fetal and newborn period, their response to acute and chronic neonatal lung disease is unreported. In control infants (n=28) dying of non-cardiopulmonary causes (1 day to 6 months), bombesin positive cells identified immunohistochemically were localized mainly in the bronchiolar epithelium and showed a gradual decrease in number during the first six months of life. Infants with acute and chronic pulmonary disease (n=26) demonstrated a similar distribution but marked differences in the number of bombesin positive cells when compared to age-matched controls. Infants dying with acute hyaline membrane disease showed a significant decrease ($P<.01$) in both the number of bombesin positive cells/bronchiole and the number of cells/cm² of lung tissue. Infants dying with bronchopulmonary dysplasia showed a two-fold or greater increase ($P<.01$) in the same parameters. Neither the function of these cells nor the effects of bombesin and serotonin on the fetal and newborn lung are well understood, but these data indicate that these cells and their products may play a previously unrecognized role in influencing airway and/or vascular tone under normal and pathological circumstances.

1671A

RESPIRATORY FAILURE AND THE EXPIRATORY CONTROL OF BREATHING IN LAMBS. P. Johnson, R. Harding and D.J. Henderson-Smart, Nuffield Inst. Med. Res., University of Oxford, U.K. (Sponsored by P. Ballard).

During quiet sleep (QS) in lambs phasic laryngeal adduction (Thyroarytenoid TA) is sufficient to elevate subglottic pressure to 10 cms H₂O. This does not occur in active sleep (AS). Present studies using chronically implanted emg electrodes, air flow and pressure measurements were to determine the contribution of the upper airway (larynx), and the diaphragm on the maintenance of lung volume and respiratory drive. In QS respiratory frequency (RF) fell from 8 days to 32 days postnatal age [91±11 to 31±3 breaths min] and was related to an increase in expiratory time (TE). Subglottic pressure, expiratory laryngeal resistance and integrated TA emg activity correlated well with TE. The diaphragm did not contract uniformly; up to 45% of the contraction time of the vertebral diaphragm was expiratory whereas the paratendinous diaphragm contraction ceased at end-inspiration. Removing the positive airway pressure during expiration by opening a tracheotomy caused 1) an increase in expiratory laryngeal adduction and in expiratory activity of the diaphragm; 2) a fall in respiratory frequency. Since vagal blockade had the same effect, pulmonary vagal pressure-sensitive afferents control the laryngeal adductors and the expiratory activity of the diaphragm. Preventing expiratory resistance to airflow during QS leads, to a loss of RF, lung volume and sometimes respiratory failure, overriding the normal chemical drive to breathing. This finding may relate to future sleep-related respiratory failure. FSSID NO. 26.

1672

NON-ASSOCIATION OF CELL CONTENT WITH RESPIRATORY DISTRESS IN ADULT RABBITS ASPIRATING HUMAN AMNIOTIC FLUID (AF). James H. Jose, Richard L. Schreiner,

L.D. Mirkin, James A. Lemons, Edwin L. Gresham. (Spon. by Jerry Bergstein), Indiana University School of Medicine, Indiana University Hospitals, Department of Pediatrics, Indianapolis.

Aspiration of uncontaminated AF is considered by some to be one cause of neonatal respiratory distress due to alveolar plugging by its cellular content. We examined the degree of respiratory compromise that occurred in adult rabbits after being administered human AF of varying cell counts. Experimental groups received either 4 or 6 cc/kg of human AF (n=15), saline (n=9), a 10% meconium solution (n=10), or nothing (n=6). Saline was used to provide a control fluid without solid elements while meconium was included to ensure that the experimental model could produce a well-characterized aspiration syndrome. There was one death in the AF group, 0 in the saline group and 5/10 meconium animals died. The epithelial cell count of the AF samples (n=15, mean=717 cells/ml³, range=15-2370) was slightly higher than previously reported values (Ob Gyn 49:280). There was no correlation between the cell count of the AF aspirated and the P_{O2} at 10, 30, 60 and 90 min and 2, 6 and 24 hrs, nor with lung weight or residual volume. Pressure-volume curves of AF animals were nearly identical with those of controls. Histological findings were similar in the AF and control groups with regard to leukocytes, alveolar macrophages and atelectasis. These findings indicate no correlation between AF cell count and the degree of respiratory compromise and lung pathology in adult rabbits.

● 1673

BENIGN EFFECTS OF HUMAN AMNIOTIC FLUID (AF) ASPIRATION IN NEONATAL RABBIT PUPS. James H. Jose, Richard L. Schreiner, Aslam R. Siddiqui, Mervyn Cohen,

James A. Lemons, L.D. Mirkin. (Spon. by Jerry Bergstein), Indiana University School of Medicine, Indiana University Hospitals, Department of Pediatrics, Indianapolis.

Aspiration of AF is considered by many to be a cause of respiratory distress. We investigated the effect of aspiration of human AF on the newborn rabbit. 85 cesarean delivered pups (30-31 days gest) were given 0.4 ml (11 ml/kg mean) AF, saline or 10% meconium solution by transtracheal puncture prior to the first breath. Controls were sham-injected. Tc99 added to the aspiration fluids demonstrated thorough distribution on lung scan. All meconium animals died in <15 min. Chest radiographs at <2 hrs age revealed abnormalities in 4/13 AF, 4/10 saline,

	n	Deaths	Respiratory Rates			Lung wt/Body wt
			8 hrs	16 hrs	24 hrs	
AF	20	2	75±4*	74±4	89±6	.017±.001
Saline	19	0	74±5	77±5	79±4	.015±.001
Meconium	11	11	--	--	--	--
Control	25	1	67±2	77±3	82±5	.016±.004

*Significantly different from control $p<.05$

and 2/12 control animals. All films (but one AF animal) were normal at 24 hrs. Lung wt/body wt ratios, static deflation curves, and lung histology of AF animals were not significantly different from saline or control animals. Based on these findings, we conclude that aspiration of substantial quantities of human AF is benign in its effects on the newborn rabbit.

1674

EFFECTIVENESS OF CHEST TUBE PLACEMENT IN THE NEONATE.

August L. Jung, Robert W. Allen, and Patrick Lester (Spon. by Lowell Glasgow), University of Utah College of Medicine, Dept. of Pediatrics and Radiology, Salt Lake City, Utah.

Success of chest tube placement for evacuation of a pneumothorax from two thoracostomy approaches was compared, Superior (1-3rd ICS MCL) vs. Lateral (4-6 ICS AAL). Effectiveness, as it related to the tube tip position in the chest, was also compared, anterior vs. posterior. A retrospective review was conducted of all NICU admissions in 1979. Fifty-seven neonates had 91 pneumothoraces for which 119 chest tubes were placed.

Chest tubes evacuated a pneumothorax significantly more often if the tube lay anterior to the lung vs. posterior, 45/47 (96%) vs. 17/40 (42%) respectively. The superior insertion route resulted in significantly more anterior tubes than the lateral insertion 35/41 (85%) vs. 33/74 (47%) respectively. Superior anterior tubes were virtually as effective as lateral anterior tubes, 21/23 vs. 24/24 respectively. Complications included a 10% encroachment of superior tubes on the mediastinum vs. 32% for lateral tubes. Other complications occurred predominantly with lateral tubes. We conclude pneumothoraces were more effectively evacuated with anterior position of the chest tube tip. The lateral thoracostomy approach resulted in more posterior tubes and more complications. The superior insertion site seems an acceptable alternative to, if not better than, the traditional lateral insertion site, for evacuation of neonatal pneumothoraces.

1675

LACK OF VOLUME-RELATED CONTROL OF VENTILATION IN NEONATES. A. Krauss, V. Alfaro, R. Goldstein, W. Frayer, P. Auld, Perinatology Cent. Dept. Peds. Cornell U. Med. Coll., New York, N. Y.

Breathing at large tidal volumes should result in inspiratory shortening if the Hering-Breuer reflex is active. This has been observed in human newborn infants by some investigators (Tausch et al J. Ped. 1976;88:102) but not by others (Boychuk et al J. Phys. London 1977;270:653). In the present study, 24 pre-term infants were exposed to 0%, 2%, 5%, and 8% CO₂ at 0, 5, and 10 cm H₂O of end expiratory pressure via endotracheal tube. The aim of this study was to increase tidal volume with CO₂ stimulation at the same time lung volume was increased via PEEP. An average of 62% of the PEEP was transmitted at 5 cm H₂O and 54% at 10 cm H₂O. Using a computer-assisted program, recordings of tidal volume were made at each level of PEEP and CO₂ after 3 minutes of CO₂ breathing, and analyzed for inspiratory time (Ti), expiratory time (Te), minute volume (Ve), and tidal volume (Vt). Plots were then made of 60-100 breaths for each level of CO₂ and PEEP. Despite a 3-4 fold increase in tidal volume which accompanied CO₂ breathing, and a 2x increase in minute volume, Ti did not shorten with increasing Vt. In many cases a slight positive correlation was observed between Vt and Ti, and a negative correlation between Vt and Ti-1. These results confirm those of Boychuk, Rigatto, and Seshia and suggest that (1) vagal control of ventilation via Hering-Breuer afferents is deficient in the neonatal period, or (2) newborn infants breathe at tidal volumes and lung volumes below the vagal threshold.