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CILIARY ULTRASTRUCTURE AND NASAL MUCOSAL HISTOLOGY IN CYSTIC FIBROSIS Dustan C. Osborn, Irene M. O'Kane & Cornelius T. Gillespie (Spon. by Richard B. Gold-bloom), Dalhousie University, Department of Pediatrics, Halifax, Nova Scotia

Mucociliary activity is defective in patients with cystic fibrosis (CF) but the ultrastructure of cilia in CF has not been investigated previously. Since defects in ciliary ultrastructure have been reported in another chronic pulmonary disease (NEJM 297,1,1,1977) the ultrastructure of cilia from patients with CF was studied. Nasal and tracheal mucosa was biopsied in 10 CF patients under direct visualization at the time of bronchial lavage and tissue was fixed for electron microscopy in the usual manner. Nasal mucosal biopsies from healthy individuals and from asthmatics on aerosol therapy, matched for age, were also obtained. The architecture of CF cilia seen in cross section was normal (9 + 2 microtubular arrangement, dynein side arms, spokes, and ciliary orientation). However, the mucosal architecture was grossly distorted. The mucosal surface was fragmented with thickened submucosa, increased goblet cells, fewer ciliated cells and sparse cilia. The picture is that of a traumatized epithelium. Further studies are required to determine whether these changes reflect the disease itself or the result of repeated aerosol therapy.

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BRONCHOPULMONARY DYSPLASIA. Charles L. Paxson and David L. Bolam, University of Nebraska Medical Center, Omaha, Nebraska. (spon. by G. C. Rosenquist).

The roles of inspired oxygen and positive pressure ventilation in the development of bronchopulmonary dysplasia are controversial. We initiated this prospective study to elucidate this problem.

All babies with lung disease requiring ventilation ($paO_2 < 60$ in 0.6 FiO_2) were assigned to an alternating monthly protocol. One group received initial ventilation with tidal volumes of ~ 6 ml/kg and liberal positive end-expiratory pressure (mean PEEP > 6 cm H_2O). The other group received tidal volumes of ~ 3 ml/kg, and less PEEP (mean < 6 cm H_2O). Oxygen was administered as needed to maintain $paO_2 = 60-80$ torr.

Analysis after 1 year revealed no differences in demographic factors, the number of survivors or the number of patients with BPD in each group. However, infants with BPD exhibited a higher incidence of pre-existing "air block" and received ≥ 0.6 FiO_2 longer than those who did not develop BPD.

(see table)

Patients	B.W.	PIP	PEEP	.6 FiO_2	Air block
44 no BPD	1722	41	5.6	25 hr.	14 (32%)
11 BPD	1281	44	6.2	75 hr.	8 (73%)
p value	-	-	-	< 0.01	< 0.025

The data suggests that prolonged high inspiratory oxygen concentrations may be the predominant factor in the etiology of bronchopulmonary dysplasia.

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RESPIRATORY EVALUATION OF CHILDREN IN A CHLORINE GAS DISASTER: IDENTIFICATION OF RISK FACTORS

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On 9/30/77 a chlorine gas leak at a water treatment facility in Philadelphia forced the evacuation of a housing project. In the next 12 hours, 56 children were brought to the emergency room and evaluated by physical exam (PE), chest x-ray (CXR), and pulmonary function tests (PFT). 29/56 were well and had normal PE. All 29 remained well on followup at 24 hrs. and again at 3 mos.

A positive past respiratory history (PPRH) was present in only 5. 27/56 were symptomatic and had one or more abnormal findings on initial evaluation, (25 PE, 2 CXR, 10 PFT). Arterial blood gas (ABG) studies showed hypoxia in 7/26 patients (pO_2 55-89 torr). Therapy consisted of IPPB and physical therapy and postural drainage; 10/27 required bronchodilators for severe or persistent bronchospasm which occurred in 8/10 with a PPRH but in only 4/17 without a PPRH. Abnormal PFT were found in 7/10 with a PPRH but in only 3/17 without a PPRH. On followup, 10 were symptomatic at 1 week, 6/5 with PPRH) were symptomatic at 3 months.

In summary, acute exposure to chlorine gas may cause respiratory symptoms and transient abnormality of PFT and ABG, especially in children with asthma. PE and PFT were useful in identifying those patients requiring hospitalization. A PPRH identified the majority of those who developed persistent respiratory difficulty.

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REGIONAL VENTILATION ($\dot{V}$) AND PERFUSION ($\dot{Q}$) BY TETRAPOLAR ELECTRICAL IMPEDANCE PLETHYSMOGRAPHY (TEIP) IN CYSTIC FIBROSIS (CF). George Polgar, James A. Spence,

Tzong R. Weng, and Jan Nyboer. Wayne State University School of Medicine, Children's Hospital of Michigan, Respiratory Disease Division, Detroit, Michigan.

We determined $\dot{V}$ and $\dot{Q}$ indices as described in *Pediat. Res.* 11: 579/1248, 1977, over 6 lung regions of 11 patients with CF, 10-22 years of age. The lung disease was scored as severe in 5, moderate in 5, mild in 1, based on chest x-ray (CXR), pulmonary function tests and clinical status. Lung scans were performed in 2 severe patients. Diffuse abnormalities with or without distinct unilateral or bilateral localized findings by CXR, were compared with a variety of unilateral, bilateral, uniform or mixed changes of $\dot{V}$ and $\dot{Q}$ indices by TEIP. Good agreement between them was found in only about 30% of the cases, with TEIP generally revealing a larger number of abnormalities. The topographical correlation of findings by CXR and TEIP was poorer still. The average magnitude of $\dot{V}$ and $\dot{Q}$ differences agreed with the score of lung disease in about 50% of all patients. Because TEIP data reflects subtleties in regional lung function it would not be expected to correlate well with conventional disease scores. When comparing TEIP and lung scans, there was 80% agreement in the number of abnormal lung regions and their topographical distribution, and 60% in the estimated magnitude of the abnormalities. We conclude that TEIP can provide a simple tool, approaching the accuracy of lung scan, for examining the distribution of ventilation and perfusion in cystic fibrosis.

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OXYGEN TENSION (O_2) MEASUREMENTS IN PRETERM INFANTS.

Deborah M. Barger and Charles L. Paxson, Jr. Univ. of Nebr. Med. Ctr. Omaha, NE (Spon. by G.C. Rosenquist)

O_2 measurements are fundamental to providing care for infants with lung disease. We have compared simultaneous preductal and postductal O_2 tension measurements in 15 preterm infants. Preductal measurements were obtained by sampling right radial or digital arteries, or transcutaneously (To_2) from the right thoracic region (internal mammary artery). Postductal measurements were obtained from aortic catheter samples at L3, capillary heel samples or via right thigh To_2 . The poorest correlations of O_2 measurements were between aortic and digital samples (correlation coefficient, $r = 0.29$). Good correlations existed between thigh To_2 and aortic samples ($r = 0.69$), and thoracic To_2 and aortic samples ($r = 0.75$).

Observations by other investigators that suctioning produces a fall in To_2 were confirmed by transient falls in O_2 , but suctioning in general resulted in a prolonged rise in thoracic To_2 . Many infants exhibited falls of To_2 from normal to hypoxic levels without any apneic spells or physical manipulation.

We suggest that Skin O_2 measurements are valuable adjuncts to aortic samples, in determining oxygenation in preterm infants but placement of the skin sensor is of prime importance. More experience is needed to decide if chest physiotherapy is beneficial or harmful.

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THE EFFECTS OF LUNG INFLATION ON THE VARIOUS PHASES OF THE RESPIRATORY CYCLE IN PRETERM INFANTS.

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Traditionally the Hering-Breuer reflex has been assessed by the presence and length of apnea and/or prolongation of expiratory time (T_e) during sustained lung inflation. In recent years a decrease in inspiratory time (T_i) during lung inflation has also been suggested as an indicator of the inflation reflex. Both T_e and T_i have not been analyzed systematically in neonates with stratified increase in lung volume. We decided, therefore, to examine the effects of sudden and sustained lung inflation on T_i , T_e , and duration of apnea in preterm infants. Ten babies (G.A. 31 ± 1 wk; B.W. 1500 ± 110 g) were studied. Lung inflation was obtained by applying negative pressure around the chest using a negative pressure incubator. Response time of the system was less than .3 sec. After a control period, we increased lung volume (FRC) by 15%, 25%, 35%, and 60%. We measured T_i , T_e , apnea and FRC before and during lung inflation. We found a significant increase in T_i , T_e , and duration of apnea with an increase in FRC by as little as 15% ($p < 0.01$). These results suggest: 1) preterm infants show significant increase in T_i and duration of apnea during sustained lung inflation indicating potent Hering-Breuer reflex; 2) contrary to expectations, T_i increased significantly with lung inflation. We speculate that changes in T_i and T_e during lung inflation are not exclusively vagal dependent and may reflect changes in chest wall reflexes or in respiratory muscle performance.