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PERSISTENT AIRWAYS OBSTRUCTION AND BRONCHODILATOR RESPONSIVENESS IN INFANTS FOLLOWING LOWER RESPIRATORY INFECTION (LRI). Robert S. Tepper, Wayne J. Morgan, Anne Wright, Kathy Cota, Lynn M. Taussig, Dept. Ped.; Div. Resp. Sci., Arizona Health Sciences Center, Tucson, AZ.

LRIs during infancy have been found to be associated with increased respiratory symptoms and impaired pulmonary function in later years. We measured maximal flows at functional residual capacity, $\dot{V}_{max}FRC$, in 10 hospitalized infants (age 1-16 mo) using the rapid thoracic compression technique. FRC was measured by helium dilution technique. Eight of 10 infants had follow-up testing while asymptomatic at 1-3.5 months post discharge. 110 normal babies of similar age were used for comparison. During the initial testing 6/10 LRI infants had abnormal $\dot{V}_{max}FRC$. At the time of follow-up 4/8 patients had low $\dot{V}_{max}FRC$ but all had normal lung volumes, and 4/6 infants tested with inhaled metaproterenol demonstrated an increase in $\dot{V}_{max}FRC$. The slope of the regression equation of $\dot{V}_{max}FRC$ vs. length for the normals was significantly greater ($p < .05$) than for the LRI infants when asymptomatic at follow up (5.81 vs. 1.70). We also studied 4 infants prior to their first LRI (mean age=1.8 mo) and at least 6 months following their LRI (mean age=9.4 mo); of these, 3 demonstrated an abnormally small increase in flows with growth despite a normal increase in lung volume. We conclude that infants with LRIs have evidence of either persistent airways obstruction or abnormal airway growth several months following an acute LRI and that some respond to an inhaled bronchodilator even when clinically asymptomatic. (Supported by NHLBI SCOR Grant #14136).

1817

SHAPE AND MOMENT ANALYSIS OF TIDAL EXPIRATION IN NORMAL (NL) AND BRONCHOPULMONARY DYSPLASIA INFANTS (BPD). Wayne J. Morgan, Robert Tepper, Edith Wilcox, Lynn M. Taussig, and GHMA Pediatricians, Dept. Ped. and Div. Resp. Sci., Arizona Health Sciences Center, Tucson, AZ.

We evaluated several flow, time and volume variables on tidal flow-volume (FV) loops in 73 NL and 15 BPD infants, who were the same age post-conception. We found that the shape of the expiratory FV curve defined by the ratio of flow late in exhalation ($\dot{V}_{75}$) to peak tidal expiratory flow ($\dot{V}_{max}$), and moment analysis best discriminated the two groups. The BPD group had a higher mean $\dot{V}_{max}$, and lower mean $\dot{V}_{75}/\dot{V}_{max}$ ratio than the NL group. Moment analysis showed a significantly shortened mean transit time (MTT), greater skewness (SKEW) and coefficient of variation (COV) in expiratory FV curves of the BPD group.

	Normals	BPD	p Value	
RR (per min)	48.9 ± 1.4*	57.6 ± 4.6	<.05	*Mean±SE
$\dot{V}_{max}$ (ml/sec)	71.0 ± 1.9	81.1 ± 4.6	<.05	
$\dot{V}_{75}/\dot{V}_{max}$ (%)	71.7 ± 1.2	58.9 ± 4.2	<.001	
MTT (sec)	.33 ± .09	.25 ± .02	<.01	
SKEW	.47 ± .02	.74 ± .05	<.001	
COV	.54 ± .01	.62 ± .02	<.001	

We conclude that the tidal FV patterns of BPD infants are different from NL with a greater and more rapid peak flow, greater relative decrease in flow during exhalation, and a larger variation of transit times. Also, the $\dot{V}_{75}/\dot{V}_{max}$ ratio appears to be the best test for assessing lung disease using tidal FV curves since it is as reproducible, but easier to calculate than moment analysis. (Supported by NHLBI SCOR Grant #14136)

1818

EFFECTS OF PARENTAL SMOKING ON LUNG FUNCTION IN INFANTS UNDER 4 MONTHS OF AGE. Wayne J. Morgan, Anne Wright, Kathy Cota, Lynn M. Taussig and GHMA Pediatricians, Dept. of Pediatrics; Division of Respiratory Sciences, Arizona Health Sciences Center, Tucson, AZ.

Exposure to parental smoking has been associated with decreased lung function and respiratory symptoms in later life. Animals exposed to cigarette smoke have been reported to have altered lung volume compared to controls. We selected 87 infants <4 mo who were randomly enrolled in a prospective study of risk factors for lung disease. Maximal flows at FRC ($\dot{V}_{max}FRC$) were measured by the rapid chest compression technique, and FRC by helium-dilution. 20 infants' mothers smoked during the pregnancy (S) and 67 did not (NS). There were significantly ($<.001$) more smoking fathers in the S group. The prevalence of chronic respiratory problems in the family was the same in the both groups. Results are summarized in the table:

Group	BW (Kg)	Mean Age (mos.)	FRC (ml/Kg)	$\dot{V}_{max}FRC$ (FRCs/sec.)	
S	3.25	2.8	21.8±1.2*	1.15±.1	* $\bar{x}$ ±SE
NS	3.54	1.8	19.8±.4	1.30±.7	
p	<.01	p < .01	.05<p<.1	N.S.	

These preliminary data suggest that infants born to smoking mothers show a tendency to have a larger lung parenchyma and lower volume-corrected flows. We speculate that dysplastic growth patterns may occur in-utero, and are consistent with decreased flows, but larger lung volumes are observed in older children raised by smoking parents. (Supported by NHLBI SCOR Grant #14136).

1819

RESPONSE OF THE PULMONARY VASCULATURE OF THE FETAL LAMB TO HYPERBARIC OXYGENATION. Frederick C. Morin, Edmund A. Egan, Claus E.G. Lundgren (Spon. by Donald L. Shapiro). Univ. of Rochester School of Med., Strong Mem. Hosp., SUNY at Buffalo, Children's Hosp., Depts. Peds., Rochester, NY Buffalo, NY.

At birth, pulmonary blood flow increases from approximately 7% of combined ventricular output to 50% of combined ventricular output. Using a hyperbaric chamber, we have begun to investigate the effects of an increase in oxygen alone on pulmonary blood flow in the intact intrauterine fetal lamb. Under anesthesia, catheters were placed in the superior vena cava, pulmonary artery, and carotid artery of the fetal lambs and the lambs were then returned to the uterus. The fetuses were studied 3 hours after completion of surgery and then again 4 days after completion of surgery. For each experiment, the pregnant ewe was placed in a hyperbaric chamber at ambient pressure breathing room air. A sample for arterial blood gas determination was drawn, vascular pressures were recorded, and radioactive microspheres were injected to the superior vena cava to measure the percentage of right ventricular output distributed to the lungs. In 3 experiments in near-term fetuses, P_{aO_2} increased by 18 to 32 torr. These increases were associated with 6-22 fold increases in pulmonary blood flow. In two experiments at two-thirds gestation, P_{aO_2} increased 12 and 203 torr, while pulmonary blood flow increased only 3 and 1 fold. In these preliminary experiments, increasing P_{aO_2} alone produces increases in pulmonary blood flow similar to those seen at birth. In addition, the pulmonary vascular response to oxygen appears to develop during the last trimester.

1820

AN INVESTIGATION OF THE MECHANISMS BY WHICH HYPERVENTILATION DECREASES PULMONARY VASCULAR RESISTANCE IN THE NEWBORN LAMB. Frederick C. Morin (Spon. by Donald L. Shapiro). University of Rochester School of Medicine, Strong Memorial Hospital, Dept. of Pediatrics, Rochester, NY.

We have previously reported that hyperventilation decreases pulmonary vascular pressures in the newborn lamb. The following study examined whether these pulmonary vascular effects are due to mechanical effects of hyperventilation or due to the respiratory alkalosis, and whether the effects of hyperventilation are mediated by prostaglandin production. Six newborn lambs were anesthetized and appropriate vascular catheters were placed. Each lamb was studied during three baseline periods separated by two periods of hyperventilation, one with hypocarbia and one with normocarbia. Arterial blood gases were normal during the baseline periods and were unchanged during the hyperventilation with normocarbia. During hyperventilation with hypocarbia, marked respiratory alkalosis was produced. During hyperventilation with hypocarbia, pulmonary artery pressure decreased significantly from $25.8 \pm 5.53SD$ to $17.7 \pm 2.66SD$ ($p < .01$) and pulmonary vascular resistance decreased significantly from $0.99 \pm .037$ to $0.07 \pm .029$ ($p < .03$). There was no change in these values during hyperventilation with normocarbia. In preliminary studies on 4 newborn lambs pretreated with indomethacin, pulmonary artery pressure and pulmonary vascular resistance decreased during hyperventilation with hypocarbia. In newborn lambs, the pulmonary vascular effects of hyperventilation are not due to mechanical factors and may not be due to prostaglandin production.

1821

BRONCHOPULMONARY DYSPLASIA AND GASTROESOPHAGEAL REFLUX. M.D. Mullett, E. Hrabovsky. (Spon. by B. Jones). West Virginia University Medical School, University Hospital, Department of Pediatrics, Morgantown.

A retrospective review of 953 admissions to the newborn intensive care unit over 3 years reveals 67 infants with bronchopulmonary dysplasia (BPD). The diagnosis was made if the infant required oxygen at 21 days of age and had an x-ray compatible with BPD. 16 infants during this 3 years were diagnosed as having severe gastroesophageal reflux with life threatening symptoms including late severe apnea, aspiration pneumonia and refusal to eat causing failure to thrive. Only two of the 16 were well growing premature. The other 14 infants with reflux also had BPD. The occurrence of reflux in our BPD patients was 21%. The overall mortality for infants with BPD was 31%. Mortality for infants with BPD and reflux was 21%. Screening for reflux was not done on infants without the life threatening events noted above and since small recurrent episodes of aspiration may be missed on an x-ray compatible with BPD, consideration may need to be given to reflux as a major contributor to the downhill course of BPD.