1182

CHEST WALL COMPLIANCE IN PREMATURE INFANTS. Tilo Gerhardt, Eduardo Bancalari, University of Miami, School of Medicine, Dept. of Pediatrics, Miami, Fl.

Twenty six premature infants, mean BW 1480 g, mean gestational age 32 wks. who needed mechanical ventilation because of respiratory failure were studied. Spontaneous respiration was suppressed by slight hyperventilation. Chest wall compliance was calculated by dividing tidal volume (VT) by the change in esophageal pressure (Pes) obtained at different peak inspiratory pressures. Changes in Pes reflect the amount of airway pressure transmitted to the pleural space. Means for VT and Pes measurements were:

Pes (cmH20)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0
VT ml/kg	3.5	6.7	10.0	13.3	16.9	19.9	22.8	25.8	31.0

The results indicate that there is a linear correlation between VT and Pes (r=0.95) up to maximal inflation of the lung. The slope of the regression was 6.4 ml/cmH20xkg, which is the value of chest wall compliance. No linear correlation was found between airway pressure and Pes because the pressure volume curve of the lung is not linear but becomes progressively flatter at high volumes. Because chest wall compliance is four to six times higher than the normal lung compliance, no more than a sixth to a fourth of the airway pressure can be transmitted to the esophagus during positive pressure ventilation. Transmission will be even smaller when lung compliance is decreased as it occurs in hyaline membrane disease or when the tidal volume reaches the flatter part of the pressure volume curve of the lung. This poor transmission may protect the cardiovascular system from the effects of positive pressure.

1183

LUNG PRESSURE VOLUME CURVE IN PREMATURE INFANTS WITH PDA. Tilo Gerhardt, Eduardo Bancalari, University of Miami, School of Medicine, Dept. of Pediatrics Miami, Florida.

The effects of a left to right shunt through a patent ductus arteriosus (PDA) on the mechanical properties of the lung were evaluated in 16 premature infants, mean BW 1130 g, GA 30 weeks. All infants required mechanical ventilation and pressure volume (P/V) curves were constructed using the difference between airway and esophageal pressure as transpulmonary pressure (PL) and the tidal volume measured simultaneously at different peak inspiratory pressures. Results of lung compliance (CL) (ml/cmH20xkg) were compared with those obtained in normal infants and prematures with hyaline membrane disease (HMD).

PL cmH20	5	10	15	20	25	30	35
PDA (N=16)	0.76	0.71	0.71	0.68	0.68	0.65	0.61
HMD (N=16)	0.48	0.50	0.54	0.51	0.46	0.41	0.36
Normal (N=2)	2.24	2.12	1.78	1.55	1.34	1.20	1.04

Infants with PDA showed a low CL which only decreased slightly with increasing PL, reflecting an almost linear P/V curve. This is in contrast to the PV curve obtained in normal infants and in infants with HMD in whom after an initial linear portion there is a progressive flattening due to alveolar overdistension resulting in a decrease in CL. The decreased CL and the linear course of the P/V curve in infants with PDA may be due to increased interstitial fluid leading to a decrease in tissue elasticity that prevents alveolar overdistension. The characteristics of the P/V curve in infants with PDA can be used to differentiate between pulmonary failure secondary to PDA or HMD.

1184

PULMONARY VASODILATOR ACTION OF TOLAZOLINE IN THE NEWBORN. Boyd W. Goetzman and Jay M. Milstein. University of California, Davis - Sacramento Medical Center, Sacramento, California. (Spon. by Richard P. Wennberg.)

Tolazoline has been reported to reduce the elevated pulmonary vascular resistance found in some clinical conditions, including the syndrome of persistence of the fetal circulation in the newborn. Tolazoline, an α-adrenergic blocking agent, also has direct actions on cardiac and smooth muscle which are described as "histamine-like." We evaluated the pulmonary vasodilator effect of tolazoline in newborn lambs before and after the administration of the specific histamine H_1- and H_2-receptor antagonists, diphenhydramine and metiamide, respectively. Lambs, 0-3 days old, were anesthetized and instrumented for measurement of pulmonary artery pressure, left atrial pressure and pulmonary blood flow. Pulmonary vascular resistance, PVR, was then calculated. Pharmacologic agents were administered in bolus form via the inferior vena cava in the following doses: tolazoline, 1 mg/kg; diphenhydramine, 5 mg/kg; and metiamide, 5 mg/kg. The mean change in pulmonary vascular resistance, %ΔPVR, produced by tolazoline after histamine receptor blockade is given below.

n	8	4	4	8
Histamine Antagonist	None	H_1	H_2	H_1+H_2
%ΔPVR	-25±8	-13±4	-18±6	+6±8

It is concluded that the pulmonary vasodilator action of tolazoline is entirely mediated by histamine H_1- and H_2 receptors.

1185

INCREASED WORK OF BREATHING ASSOCIATED WITH NASAL PRONG CPAP. Steven L. Goldman, June P. Brady, and Fe M. Dumpit Univ. of Calif., Childrens' Hospital, Dept. of Ped., and Cardiovascular Research Institute, San Francisco.

Nasal prong CPAP may add to the risk of respiratory failure in the infant with hyaline membrane disease(HMD) by increasing work of breathing. In 6 preterm infants with HMD, respiratory rate(f), minute ventilation($\dot{V}$), tidal volume(V_T), esophageal pressure(Δ Pes), and arterial blood gases were compared using nasal prongs and Bourns face mask at the same FiO2 and CPAP.

	Mask	Prongs	p
f	83	74	.04
V_T(ml/kg)	4.3	5.0	NS
$\dot{V}$(ml/kg/min)	358	370	NS
PO2	87	77	.05
Δ Pes(cm H_2O)	10.4	12.5	.08

There was no difference in $\dot{V}$, pH, and PCO2. f and PO2 were significantly higher, and V_T and Δ Pes tended to decrease with mask CPAP. Compliance was lower with the mask but the change was not significant(N=3). The total Δ Pes over 1 minute decreased with the mask. Because there was no increase in compliance with the mask, this decrease in Δ Pes represents a decrease in resistive work. This was confirmed in 3 infants whose work of breathing was 26% less with the mask compared to the prongs. The resistance of the prongs is 10 times the resistance of the mask. With a constant $\dot{V}$, f must decrease and V_T must increase if the obligate increase in work is to be minimized.

Our data suggest that the high resistance inherent in nasal prongs must increase work of breathing. Thus, other modes of delivery of CPAP should be considered in the already compromised infant with HMD.

1186

COMPLICATIONS OF PROLONGED ENDOTRACHEAL INTUBATION (PEI), G Gregory, M Willis, Univ. of Calif., San Fran.

We prospectively evaluated the complications of PEI in 90 infants (800-5140 g) who were intubated 13,371 hours (1.5 patient years). There were 118 tubes in place an average of 147 hours (38-668). 95 tubes were clear at extubation, 18 thinly coated with mucus but clear, and 5 occluded. 3/5 occluded tubes had a Murphy eye. 3/5 were partially occluded and only discovered at extubation. All occluded tubes were from infants weighing >2100 g. Bronchial intubation (BI) occured 36 times in 29 patients, 20 immediately after intubation. 50% of BI were in patients <1500 g. 57% of late BI occurred with inadequate taping. Accidental extubation occurred 6 times in 5 infants weighing 1220 +480 g. Their activity was normal; 2 had inadequate taping. Endotracheal tubes were changed 21 times in 13 infants after 1.5-461 hours of intubation; 2 for occlusion, 4 for suspected occlusion, 6 for no air leak at 15 cm H20, 3 for malposition and 6 miscellaneous. On 88 occasions the tube was resutured and taped, 22 due to initial malposition of the tube. Of the remaining 66, 17% were high, 33% low and 50% loose. Retaping and suturing occurred every 8.4 days on average. Slight bleeding occurred with suctioning in 30 patients 7% of the time. No infant had pulmonary hemorrhage. There was no evidence of subglottic stenosis at post or discharge despite 38-1102 hours of intubation. We conclude that 1) tube occlusion usually occurs in large babies, 2) malposition and accidental extubation usually occurs in small babies, 3) the tube complication rate is low, 4) ½ the complications are preventable.

1187

PULMONARY FUNCTION ABNORMALITIES IN ASYMPTOMATIC CHILDREN FOLLOWING HYDROCARBON PNEUMONITIS. Dennis Gurwitz, M. Kattan, H. Levison and J.A.G. Culham. Department of Pediatrics and the Research Institute, Hospital for Sick Children, University of Toronto, Ontario, Canada.

To assess the effect of hydrocarbon pneumonitis on the developing lung we studied the pulmonary function of seventeen asymptomatic subjects, eight to fourteen years after the initial insult. Fourteen of the 17 subjects (82%) had one or more pulmonary function abnormalities, the most frequent being a high volume of isoflow. Volume of isoflow, the ratio of residual volume to total lung capacity, slope of Phase III, flow rates at 50 and 25% of vital capacity and 60% of the total lung capacity, one second forced expiratory volume and maximum mid expiratory flow rate differed significantly ($p < .05$) from age and height matched controls. Closing volume and closing capacity were not significantly different. The data show that residual abnormalities are present following hydrocarbon pneumonitis. This could be explained on the basis of small airway obstruction and/or loss of elastic recoil and are similar to the earliest changes seen in smokers and adult patients with chronic obstructive lung disease. These children may be at higher risk for the development of chronic lung disease in adulthood when exposed to exogenous factors such as air pollution or smoking.