

CARDIORESPIRATORY RESPONSES TO POSITIVE END-EXPIRATORY PRESSURE (PEEP). Carl E. Hunt, Sadi Matalon, William A. Neal, O.D. Wengensteen and A.S. Leonard (Intr. by R.V. Lucas). Dept. of Ped., Physiol. and Surg., Univ. of Minnesota, Minneapolis.

The cardiorespiratory responses to PEEP have been evaluated using the puppy as an experimental model of the normal neonatal lung. Twenty puppies at 3-4 weeks of age were anesthetized and ventilated (FI₀₂ 0.21) with pressure-controlled (P-C) and volume-controlled (V-C) assistance at PEEP levels of 0 (baseline), 5, and 10 cm H₂O. Although lesser changes occurred at 5 cm H₂O, the results summarized in the table are those occurring at 10 cm H₂O for 15 minutes.

	Change from Baseline (100%)	
	P-C	V-C
Tidal Volume	↓ to 25%	-----
Cardiac Index	↓ to 75%	↓ to 75%
Pulmonary Vascular Resistance (PVR)	↑ to 300%	↑ to 230%
Mean Airway Pressure (MAP)	↑ to 160%	↑ to 200%
Central Venous Pressure (CVP)	↑ to 160%	↑ to 200%
PaO ₂	↓ to 50%	No change
AaDO ₂	↓ to 75%	↓ to 75%
Paco ₂	↑ to 200%	No change
aADCO ₂	No change	No change

These results further define the cardiorespiratory responses to PEEP in the "normal" lung. In contrast to V-C ventilation with PEEP, which was well tolerated despite the increases in PVR, MAP and CVP, P-C ventilation with PEEP led to marked hypoventilation and progressive hypoxia, acidosis and shock after 15-20 minutes at 10 cm H₂O.

APNEA OF PREMATURITY: EFFECTS OF CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP), CUTANEOUS STIMULATION, AND LEVELS OF URINARY BIOGENIC AMINES. John Kattwinkel, Howard Nearman, Harold Mars, Marshall Klaus, Avroy Fanaroff, Peter Katona. Case Western Reserve Univ Sch of Med, Dept of Ped, Cleveland.

Etiological theories of neonatal apnea include hypoxia from pulmonary instability, neurologic immaturity, and autonomic imbalance. To explore these hypotheses, 29 infants were studied to examine the effects of increased lung volume via low-pressure nasal CPAP, increased afferent input via cutaneous stimulation and levels of urinary biogenic amines in preterm infants with apnea (>15 sec). Apnea significantly decreased with CPAP and with stimulation; dopamine and epinephrine (epi) levels were lower in infants having apnea.

GROUP	No.	BW(gms)	GA(wks)	APNEAS/hr			
				Before	During		
1. CPAP	10	1024	28	2.2	0.8 (p<.05)		
2. Stimulation	6	1103	28	4.7	2.9 (p<.05)		
3. Bio Amines*				Dopamine DOPA Norepi Epi			
a) Controls	6	1463	32	425	192	82	45
b) Apneic	7	1337	31	72	150	25	4
				(p<.05)	(NS)	(NS)	(p<.05)

The catecholamine differences compel further study of sleep states and are possible support for an abnormality of autonomic integrity. The clinical data suggest that by increasing lung volume with CPAP or increasing afferent traffic via cutaneous stimulation, respiratory efferents become more active, thus decreasing apneic spells.

ANATOMICAL DEAD SPACE (V_D) AND LUNG EMPTYING IN ASTHMA AND CYSTIC FIBROSIS (CF). Louis I. Landau, Lynn M. Taussig, Peter T. Macklem and Pierre H. Beaudry. (Intr. by Keith N. Drummond). Meakins-Christie Laboratories and The Montreal Children's Hospital, McGill University, Montreal, Canada.

Ten normal, 10 CF and 10 asthmatic children were studied to assess the contribution of lung zones emptying at different rates to curvilinearity of the maximum expiratory flow-volume (MEFV) curve. Lung volumes, MEFV curves on air and on helium-oxygen mixture and single breath nitrogen washouts were measured. Partial forced expiratory maneuvers were performed to produce flow transients exceeding maximum flow at mid-lung volumes. Normal children and those with asthma and mild CF had small or no transients and normal V_D. Those with severe CF had large transients (mean 150ml.) and large V_D (mean, 155% pred.), and the volume of the transients corresponded closely to that of the V_D. These large transient volumes were associated with increased curvilinearity of the MEFV curve and loss of helium response; whereas asthmatics with marked curvilinearity had small transients and helium responsiveness. In severe CF, the large transients suggest sequential emptying of fast and slow compartments which influences the shape of the MEFV curve. The fast component could correspond to emptying of an enlarged V_D. Any time constant inequality present in asthma and mild CF does not appear to contribute to the shape of the MEFV curve.

HEMODYNAMIC EFFECTS OF CONTINUOUS POSITIVE AND NEGATIVE PRESSURE BREATHING IN NEWBORN PIGS. Lee Mockrin, Eduardo Bancalari and Marc Rowe (Intr. by W. W. Cleveland) Dept. of Ped., Univ. of Miami, Miami, Florida.

It has been assumed that the hemodynamic effects of continuous positive airway pressure (CPAP) and continuous negative pressure (CNP) are similar. Cardiac output (CO) utilizing dye dilution curves, heart rate (HR), arterial blood pressure (BP) and central venous pressure (CVP) were measured in 5 normal newborn pigs subjected to different levels of CPAP and CNP. CPAP was supplied with a head box whereas CNP was applied with a box enclosing the chest and upper abdomen. No significant differences were found in HR and BP between CPAP and CNP. Results of CVP and CO were:

Pressure (cmH ₂ O)	0	+5	+10	+15	0	-5	-10	-15
CVP (mmHg)	0.05	1.7	3.6	4.8	0.11	-0.78	-1.56	-1.95
CO (% change)	-	0	↓9%	↓24.9%	-	↑12.3%	↑5.6%	↓7%

CVP increased as CPAP increased while the opposite occurred on CNP. CO decreased in 4/5 animals with +10CPAP and in all animals with +15CPAP. With CNP results were less consistent. CO increased on -5CNP but showed an overall tendency to decrease on -10 and -15CNP. However, this drop was smaller than the decrease which occurred on CPAP. The better CO during CNP compared to CPAP can be due in part to the decrease in CVP improving venous return from the body portions not subjected to CNP. The fall in CO above -5CNP may be due to either pooling of blood in body portions subjected to CNP or to increased pulmonary vascular resistance due to alveolar overdistension.

NON-INVASIVE MEASUREMENT OF VENTILATORY RESPONSE TO CO₂ IN NEWBORN INFANTS. Sungmin Park, Laura S. Inselman, John R. Graham, Mary A. Farrell, Ralph A. Epstein, and Robert B. Mellins. Col. of Physicians and Surgeons, Columbia University, Dept. of Ped. N. Y.

Interpretation of previous studies of ventilation in infants is difficult because of the unknown effect of tactile stimulation resulting from face and neck seals required by conventional methodology. We therefore measured minute ventilation non-invasively before and after inhalation of 4.5% CO₂, using a modification of the barometric method of Drorbaugh and Fenn, which we validated by simultaneous pneumotachography; 39 studies were performed in 23 normal newborn infants.

Mean ventilation was 251 ml/Kg/min (SD=64) before, and 526 ml/Kg/min (SD=150) after 4.5% CO₂. There was also a wide variation in the change in ventilation with 4.5% CO₂ (mean increase 115%, SD=56). These variations are of the same order of magnitude as those noted by conventional methods.

We conclude that 1) the barometric method affords a rapid and reliable means of measuring tidal volume and ventilatory response to CO₂ in infants without superimposing tactile stimulation and 2) the wide variations in resting ventilation and CO₂ responsiveness of normal infants cannot be attributed to tactile stimuli.

THE LARYNGO-TRACHEAL FUNCTION OF VENTILATED INFANTS FOLLOWING OROTRACHEAL INTUBATION DURING THE NEONATAL PERIOD. Dale L. Phelps, Alexandra D. Loew and William Oh. UCLA Sch. of Med., Harbor General Hosp., Dept. of Pediatrics, Torrance, Ca.

From Jan. 1970 through May 1973, 58 infants (birth weight, 870 to 4400 g) were treated by orotracheal intubation (3 to 1235 hrs., M = 224 hrs.) in conjunction with positive pressure assisted ventilation, and survived. The incidence of laryngo-tracheal (LT) sequelae was determined from retrospective chart review and prospective follow-up. LT dysfunction in the form of hoarseness or inspiratory stridor was present in 23 of 58 infants at extubation. LT involvement cleared within 2 weeks in 10 infants, and 8 additional infants became symptomatic at 2 weeks to 6 mo. of age. Thus, 21 of 53 (40%) infants with 6 mo. follow-up had late LT complications. At 6 mo. to 3 yrs., 43 infants were successfully followed and all but 3 eventually cleared; 1 had persistent hoarseness at 11 mo., 1 had persistent stridor due to vocal cord paralysis and 1 required tracheostomy for subglottic stenosis. The incidence of LT complications is directly proportional to the frequency and duration of intubation, (χ², 2x, p<.001). No conclusions could be drawn regarding short term steroid treatment or the type of endotracheal tube used (Cole-Foregger vs. Portex).

These data illustrate one of the undesirable sequelae of assisted ventilation with intubation and should be considered during the management and follow-up of infants with such intervention.