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NEW PEDIATRIC ENDOTRACHEAL TUBES FOR HIGH FREQUENCY JET VENTILATION (HFJV). Martin Keszler, K.N. SivaSubramanian, (Spon. by P.L. Calcagno). Dept. of Pediatrics, Georgetown University Medical Center, Washington, D.C.

An uncuffed pediatric version of the HI-LO Jet™ triple lumen tube with an intramural jet channel for distal gas delivery was compared to a proximal delivery system (a metal cannula aimed at the ET tube orifice from a distance of 1-2mm to avoid obstructing the lumen). HI-LO tubes of 2.5, 3.0, 3.5, 4.0 & 5.0mm ID were tested in 5 anesthetized paralyzed cats using the MK-800 jet ventilator, duty cycle of 30%, FIO₂ of 1.0, rates of 150 & 300 with normal & noncompliant lungs. The IDs of the metal cannula & the HI-LO tube jet channel were matched. Driving pressure was adjusted to maintain constant mean airway pressure for each pair. Under all conditions the two systems provided equally effective oxygenation & CO₂ elimination: (Proximal - P, HI-LO - D).

Mean P _O ₂	2.5P/2.5D	3.0P/3.0D	3.5P/3.5D	4.0P/4.0D	5.0P/5.0D
Normal Lung-150	300	306	399	414	421
Normal Lung-300	292	257	379	385	448
Stiff Lung-150	195	198	193	186	426
Stiff Lung-300	182	174	186	188	420
Mean PCO ₂	2.5P/2.5D	3.0P/3.0D	3.5P/3.5D	4.0P/4.0D	5.0P/5.0D
Normal Lung-150	19	19	28	25	21
Normal Lung-300	23	25	38	40	25
Stiff Lung-150	31	33	31	33	22
Stiff Lung-300	31	30	38	37	29

Both systems met the essential requirements of pediatric HFJV: stability & free expiratory channel. The HI-LO tube generated less entrainment. The pressure monitoring channel was useful & accurate.

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LOAD COMPENSATION AND LUNG VOLUME IN NEONATES. Alfred Krauss, Barbara Lewis, Peter Auld, Cornell Univ. Med. College Dept. of Pediatrics, New York City.

The pressure response to mask occlusion was measured in 16 infants between 1 and 45 days of age and 0.9-4.0 kg in weight. Measurements were made in a body plethysmograph, allowing simultaneous measurements of pressure responses and lung volume (V_{tg}). All infants, even the least mature, demonstrated progressive increases in mask pressure (P_{max}) within 2-3 breaths after occlusion. The maximum pressure and the maximum rate of change in mask pressure (dp/dt) were inversely correlated with V_{tg} (r=-.35). Individual infants demonstrated a greater increase in pressure within 3 breaths after occlusion with increasing age in 6/10 of patients studied on multiple occasions. The degree of load compensation correlated poorly with V_{tg} (r=-.26), V_{tg}/cm (r=-.22), and age (r=.24). Previously published results from this laboratory have demonstrated simultaneous increases in respiratory chemosensitivity in conjunction with increasing maturity and increasing lung volume, while failing to detect significant vagal effects with increasing lung volume. This indicates that the role of V_{tg} in regulation of respiration in the newborn infant is to stabilize blood gases and maintain normal mechanical aspects of pulmonary function. The influence of V_{tg} on the reflex control of breathing in healthy preterm and mature human infants is weak. Impulses arising within the central nervous system and modified by the chemoreceptors appear to be the most significant source of respiratory control in human neonates.

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EFFECTIVENESS OF EXTRACTED COW LUNG LIPID (CLL) IN INDUCING AND SUSTAINING NORMAL LUNG FUNCTION IN SURFACTANT DEFICIENT PREMATURE LAMBS. Melinda S. Kwong, Edmund A. Egan, Donald S. Shapiro, Robert H. Notter, Depts. Ped. and Physiology, SUNYAB, Buffalo; Dept. Ped., Univ. of Rochester.

Sterilized CLL was studied in premature lambs 132-134 days G.A. to determine if pre-breathing instillation could induce and sustain normal lung function for 2 days. CLL is a chloroform methanol extract of lavage of calf's lung containing 1% protein and flash autoclaved for sterility. We delivered 4 fetal lambs by hysterotomy, intubated them, took 10 ml of fetal lung liquid, instilled 100mg/kg of CLL in 10 ml of saline, and ventilated them immediately. Three control lambs were treated with 10 ml of saline. The lambs, sedated with nembutal, were managed using a clinical protocol. All CLL animals survived for 36-48 hours in good condition. Two control animals had a pneumothorax and 1 died at 21 hours. CLL treated lambs required mean airway pressures (MAP) of 10-15 cm H₂O for 2 hours; average MAP was <10 cm H₂O thereafter to maintain a PaCO₂ 30-45. Control animals required an average MAP >20 cm H₂O for 2 hours and 10-20 cm H₂O thereafter. FIO₂ requirements became <.4 by 7 hours in the CLL treated lambs. Control lambs required FIO₂ >.4 until 21 hours age. Lavage of the lung at sacrifice revealed 49±10uM of alveolar surfactant in CLL lambs and 17±2uM in controls. CLL treatment before breathing induces and sustains normal lung function for 36-48 hours. This appears to be a surfactant preparation and protocol appropriate for a human clinical trial.

(Supported by HL22552 & HL00945)

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BRONCHODILATOR EFFICACY OF ISOETHARINE METHYLATE ADMINISTERED BY METERED DOSE INHALER (MDI) BY BAG (B) VERSUS JET NEBULIZER (J).

Haesoon Lee, Hugh E. Evans, Interfaith Medical Center/SUNY Downstate Medical Center, Brooklyn, New York.

Beta agonists administered in aerosol form are effective and safe therapy for asthma. MDIs are convenient means of generating aerosols but patients younger than 6 are unable to learn inhalation technique. We have developed an aerosol bag of 1.2 liter capacity by modifying the standard freezer bag (Ziploc, Dow Chemical) with a mouthpiece attached in the corner. After the bag was inflated and canister activated through the mouthpiece, the patient breathed in and out of the bag 10 times (through the mouthpiece). We compared the bronchodilator efficacy of isoetharine aerosol 2 puffs (0.34 mg per puff) administered from a MDI in the modified B with 2.5 mg of isoetharine diluted in 2.5 ml of saline nebulized in a compressed air driven J in 15 stable asthmatic children ages 8 to 15. Treatment was given in randomized double blind cross over fashion over a two day period. Pulmonary function was tested before and after therapy for 4 hours. The mean baseline FEV₁S were 1.27 (B) and 1.22 (J) liter and increased 39, 41, 43, 36, 21 and 11% above the baseline period at 10, 30, 60, 120, 180 and 240 minutes after B and 32, 33, 28, 17, 7 and 5% at the same intervals after J. The differences were not significant at any time. Aerosol administered with the B form of MDI is more advantageous than the J. It is more convenient, easily portable, and cost effective with a lower dose (0.68 mgm) than required with a (J) (2.5 mg).

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LACK OF EFFECT ON CARDIAC RHYTHM FROM REPEATED DOSES OF ALBUTEROL AEROSOL (AA) ADMINISTERED FROM A METERED DOSE INHALER (MDI). Haesoon Lee, Hugh E. Evans, Interfaith Medical Center/SUNY Downstate Medical Center, Brooklyn, New York.

Beta agonists administered by aerosol are effective treatment for asthma. They produce prompt, significant bronchodilation. Side effects are few but cardiac arrhythmias may occur when the patient exceeds the prescribed dose. Our previous study (J. Peds 103:655, 1983) showed that 2 puffs of AA did not disturb cardiac rhythm. We have now studied the potential effect of frequently repeated inhalation of AA to simulate the pattern of use by some patients at home. 15 stable outpatient asthmatic children (9 to 14 years old) were treated with 2 puffs of AA (180mcg) followed either by hourly placebo or hourly AA for 5 hours (10 puffs=900mcgs) in a randomized, double blind cross over study. Cardiac rhythm was Holter monitored and pulmonary function was tested hourly for 5 hours. Heart rate (HR) was analyzed at hourly intervals. Pretreatment HR of 95bpm declined by 1-2bpm after single dose and similarly 2-5bpm from 99bpm during multiple doses. No one developed arrhythmia, and side effects were infrequent on either day. FEV₁ increased 35, 38, 42, 41, 44 and 44% above the baseline period at 30, 60, 120, 180, 240 and 300 minutes after multiple doses and 36, 40, 38, 33, 27 and 19% at the same intervals after single dose. The difference was significant (P<0.05) at 240 and 300 minutes. No cardiac toxicity occurred with hourly administration (for 5hrs) of AA using MDI. Hence there is apparently a substantial margin of safety in administration of this agent to asthmatic children.

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PROGNOSIS OF LEFT VENTRICULAR HYPERTROPHY (LVH) IN BRONCHOPULMONARY DYSPLASIA (BPD). Lucille A. Lester, Dolly Thomas (Spon. by Richard M. Rothberg. The University of Chicago, Department of Pediatrics, Chicago, IL.

Cor pulmonale or right ventricular hypertrophy (RVH) is a recognized complication of BPD, while LVH has been reported mainly at autopsy. Serial cardiac evaluations were performed on 19 infants with BPD during a 2 year period. RVH was documented by EKG and ECHO (RVH=RV wall thickness >2SD above mean predicted) in 13/19 infants; 6/19 had an ↑ RV dimension and 9/19 had abnormal RV systolic time intervals on at least 1 occasion, suggesting ↑ pulmonary artery pressure. ↑ LV wall thickness (>2SD above mean) was documented by ECHO in a sub-group of 10 infants. Six of these 10 also had LVH by EKG, and in 7/10 LVH was associated with septal hypertrophy. The LVH was present early and resolved in 2, but persisted or increased in 8 over 4 to 24 months followup. The characteristics for the 2 groups are summarized:

	n	Birth wgt.	Gest. Age	Days ventilated	Outcome
Group I (LVH)	10	1375±693 grams	30.3±3.8 wks	64.4±58	2 died, 4 chronic CHF, 2 home on O ₂
Group II (no LVH)	9	1300±359 grams	30.3±2.4 wks	39.3±31	all home; 5 with O ₂
T-test	p=ns	p=ns	p=ns	p=ns	

All babies required mechanical ventilation from birth; no significant differences were found in maximum FIO₂, peak pressure, or in the mean PaO₂ achieved during 1st 2 weeks for the 2 groups. Concomitant hypertrophy of the LV, documented in a subgroup of BPD infants was associated with a more complicated clinical course, prolonged hospitalization, and a poorer prognosis.