1855 DISTRIBUTION OF DIAPHRAGMATIC BLOOD FLOW DURING INSPIRATORY RESISTIVE LOADED BREATHING IN PIGLETS.

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Recently, it has been suggested that the diaphragm is composed of two separate muscles, its costal and crural components, that serve distinctly different functional roles depending on the demands of the respiratory system. Because blood flow to skeletal muscle is proportional to the muscular effort expended (Cir. Res. 10:94, 1962), an examination of the distribution of blood flow to the costal and crural components should be an accurate means of assessing the partition of effort within the diaphragm. We examined costal (Q_{co}) and crural (Q_{cr}) diaphragmatic blood flow on 5 anesthetized spontaneously breathing piglets (age 15-23 days, wt. 2.8-4.2 kg) in order to assess partition of effort during inspiratory resistive loaded breathing (IRL). Q_{co} and Q_{cr} were measured using radionuclide labelled microspheres during quiet breathing and after 30' of IRL. Q_{co} and Q_{cr}, expressed in cc/100 g tissue/min (±SD) increased significantly above baseline values after 30' of IRL. There were no significant differences between Q_{co} and Q_{cr} during the baseline and IRL periods.

	Q_{co}	Q_{cr}
BASELINE	14.0±4.0	14.5±3.7
IRL X 30'	41.7±14*	45.9±17*

We conclude that diaphragmatic muscular efforts, as reflected by changes in Q_{co} and Q_{cr}, increase during IRL and that the partition of effort is equally distributed between costal and crural components. (*Compared to baseline, paired t test $p<.05$).

●1856 IDENTIFICATION OF THE INTRACELLULAR PRECURSOR TO RAT PULMONARY SURFACTANT APOLIPOPROTEIN(S) A.

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The major protein components of rat pulmonary surfactant are acidic proteins, pI=4.3-4.8, referred to as Apo(s) A_1, Mr=26,000; A_2, Mr=32,000; and A_3, Mr=38,000. Although it is widely accepted that surfactant is synthesized and secreted into the airway by alveolar Type II epithelial cells, the molecular characteristics of intracellular Apo(s) A precursor(s) have not been established. Toward this end poly (A)$^+$mRNA was isolated from adult rat lungs. In vitro translation resulted in mRNA-dependent incorporation of ^{35}S-methionine into TCA-precipitable proteins. Immunoprecipitation of these translation products, with rabbit antisera directed against rat Apo(s) A, identified a protein with Mr=26,000; this protein was not precipitated by non-immune rabbit sera. Specificity of the immunoprecipitated protein was verified by competition experiments: addition of rat lung Apo A completely inhibited immunoprecipitation of Mr=26,000; addition of BSA or DPPC had no effect. Further, Mr=26,000 was not detected in in vitro translated rat liver poly (A)$^+$mRNA. Two-dimensional SDS-PAGE demonstrated that Mr=26,000, pI=4.3, co-migrated with Apo A_1 from rat lung lavage and also with protein immunoprecipitated from ^{35}S-methionine-labelled Type II epithelial cells. Addition of tunicamycin to Type II cell cultures resulted in appearance of Apo A_1 but not Apo(s) A_2 and A_3. Peptide maps of lung lavage Apo(s) A_1, A_2 and A_3 were identical. Collectively, these observations demonstrate that Mr=26,000 is the intracellular precursor to rat pulmonary surfactant Apo(s) A and that larger molecular weight forms result from extensive N-linked glycosylation of the primary translation product.

●1857 EFFECT OF ALMITRINE ON HYPOGLOSSAL AND PHRENIC ELECTRONEUROGRAMS.

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Almitrine increases breathing by stimulating peripheral chemoreceptors. Previous studies suggest clinical usefulness in adults with COPD but few data are available to decide whether almitrine would be helpful in diseases involving pharyngeal airway obstruction such as apnea of prematurity or obstructive sleep apnea. We investigated the effect of intravenous almitrine on hypoglossal (HG, an upper airway nerve), and phrenic (PHR) neural activity in eight chloralose-urethane anesthetized, paralyzed, vagotomized, ventilated cats. Recordings were made of raw and integrated HG and PHR electroneurograms (ENGs), P_ACO_2, PaO_2, arterial blood pressure and rectal temperature. We found that: 1) in a dose-response study (N=3 cats) at doses of 0.1 - 4.0 mg/kg, almitrine doses as low as 0.1 mg/kg increased both HG and PHR ENG activity, with a maximum effect at 1.0 mg/kg; 2) holding $PaCO_2$ at 40 mmHg, almitrine markedly increased HG and PHR ENG activity at all PaO_2 values from 35-175 mmHg (N=5 cats); 3) holding PaO_2 above 150 mmHg, almitrine increased HG and PHR ENG activity at all $PaCO_2$ values from 30-70 mmHg (N=4 cats); 4) in a ventilatory parameter timing study almitrine increased V_T/T_i and decreased T_i/T_{tot} at normoxia and eucapnea (N=6 cats). If the finding that almitrine increases upper airway-maintaining activity can be confirmed in unanesthetized sleeping animals, almitrine may be useful in obstructive sleep apnea and apnea of prematurity.

†1858 DETERMINANTS OF TIDAL VOLUME(V_T) DURING HIGH-FREQUENCY JET VENTILATION(HFJV).

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The very short inspiratory time(T_I) during HFJV may compromise the ability to deliver adequate V_T. To document the airway pressures needed to maintain a constant V_T(2.5 to 3.0cc/kg) (approx.dead space), T_I was varied by changing frequency(f) over 120,240 and 480/min at I:E ratios of 1:1,1:3,1:5 and 1:9. A 16g cath. was inserted in a 3.0mm ET tube in 9 adult rabbits and used to monitor ΔP(peak minus end expiratory pressure). V_T was measured via a pneumotachometer placed on the expiratory arm of the ventilator and validated with a body plethysmograph. The integrated flow signal was reset by the jet solenoid at onset and end of inspiration. At f of 240 and 480/min there was a significant inverse relationship between T_I and the ΔP required to deliver constant V_T(ANOVA $p<.05$). At T_I <50ms there was at least a 3-fold increase in ΔP. Despite the longer T_I(62ms) at f=480/min and I:E=1:1, ΔP was still increased because the shortened expiratory time produced marked air trapping. At a rate of 120/min, T_I did not significantly influence ΔP. Net air flow at the pneumotach during the on phase of the jet cycle was in the outward direction indicating lack of gas entrainment. In summary: 1)as T_I was shortened during HFJV higher ΔP was necessary to maintain V_T and 2)in this model, gas entrainment did not contribute to the delivered V_T. Duration of T_I is therefore critical for optimal V_T delivery if barotrauma is to be minimized. Furthermore, the delivery of humidification and O_2 during HFJV cannot be dependent on gas entrainment. Supp. ALA-Ohio, ALANO

1859 LUNG COMPLIANCE(C_L) AND EXPIRATORY TIME(T_E) INFLUENCE AIR TRAPPING(AT) DURING HIGH FREQUENCY JET VENTILATION(HFJV).

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At high ventilating frequencies, T_E may be insufficient for passive lung deflation, resulting in AT. To document AT during HFJV, we monitored inadvertent positive end expiratory pressure (inadv PEEP) with a 16 gauge catheter placed distally in a 3.0 ET tube and change in functional residual capacity(ΔFRC) with a body plethysmograph. In 9 adult rabbits, T_E was varied by employing frequencies(f) of 120, 240 and 480/min at I:E ratios of 1:1,1:3,1:5 and 1:9 in lungs of normal(NC_L) and decreased($\downarrow C_L$) compliance (after saline lung lavage). Peak airway pressure was varied to achieve a wide range of tidal volumes(V_T). At f of 240 and 480/min and V_T of 2.5-3cc/kg (approx dead space) there was a significant effect(analysis of variance) of T_E ($p<.01$) and lung compliance ($p<.01$) on inadv PEEP(see table). ΔFRC was accordingly influenced by T_E and C_L.

freq:480/min		Inadv PEEP(cmH_2O),n=9		ΔFRC(cc/kg),n=4	
T_E(msec)	(I:E)	NC_L	$\downarrow C_L$	NC_L	$\downarrow C_L$
62	(1:1)	12±4	10±4	25±6	8±8
94	(1:3)	7±3	5±2	17±4	5±4
104	(1:5)	6±2	4±2	14±6	3±3
112	(1:9)	5±2	3±2	9±5	3±3

At f of 120/min, inadv PEEP occurred almost exclusively at an I:E of 1:1. AT further increased at greater V_T. We conclude that AT during HFJV is accentuated with 1)lungs of normal compliance, 2)decreasing T_E and 3)increasing V_T. Therefore, as C_L improves with resolving lung disease, appropriate changes in T_E and f must be made to prevent air trapping. (ALA, Ohio)

† 1860 PULMONARY ASSESSMENT OF CHILDREN AFTER CHLAMYDIAL PNEUMONIA OF INFANCY.

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We evaluated the pulmonary status of 18 children 7 to 8 years after their hospitalization for chlamydial pneumonia of infancy. Pulmonary function tests (PFT) and respiratory questionnaire results on this group (CT) were compared to those of a control group (CR) comprised of 19 age, race and sex comparable children from the same community, or to values that other investigators have reported for normal children. Significant limitations of expiratory airflow were found in the CT group mean values compared to CR group (FEV_1 $p = .01$; FEV_1/FVC $p < 0.03$; PEF $p = .04$; and $FEF_{25-75\%}$ $p = .009$). CT group plethysmographic results revealed abnormally elevated volumes of trapped air (> 2 SD from reference means) present in 3 of 18 FRC and 13 of 18 RV/TLC ratios. These obstructive patterns were responsive to inhaled isoproterenol. Similarly, the CT group also had a significantly greater number of children with physician-diagnosed asthma than the control group (6/18 vs 1/19, $p < .03$). The obstructive PFT abnormalities could not be accounted for by recognized risk factors such as exposure to smoking at home (11/18 vs 12/19 $p = NS$) or family history of atopy (6/18 vs 4/19 $p = NS$). Our results show that chlamydial pneumonia of infancy is associated with PFT and respiratory symptom abnormalities 7 to 8 years after recovery from the acute illness.