- †1861 PROLONGATION OF INSPIRATORY TIME BY LOWER AIRWAY OCCLUSION IN CHILDREN. MK Witte, WA Carlo (Spon. RJ Martin). CWRU, Dept. Peds, RB&C Hosp., Cleve, OH
- Inspiration is strongly inhibited by volume-related vagal afferents in human neonates and animals but this reflex is not as active in human adults during normal breathing. To determine if volume-related inspiratory inhibition occurs beyond the neonatal period we performed 10±1 end expiratory occlusions in 5 patients (3-17 mos.) with cuffed tracheostomy or endotracheal tubes. Occlusion pressure and surface diaphragm electromyogram (DIA EMG) were simultaneously recorded. DIA EMG duration (T_{DTA}) was measured from the raw signal, and peak amplitude, time to peak and rate of rise of DIA EMG were quantified from moving average signals. Inspiratory time (T_i) was measured from flow signal during the breath immediately preceding occlusion and from occlusion pressure (JAP 38:335, 1975) during the first occluded effort. During control breaths T_{DTA} was longer than T_i from flow (790±110 vs 550±130 ms, p<0.01). Occlusion consistently increased T_i (550±130 to 710±230 ms, p<0.05) and T_{DTA} (790±110 to 990±130 ms, p<0.001). Peak amplitude and time to peak DIA EMG increased by 22±6%, p<0.005 and 30±4%, p<0.001, respectively, during occlusion but rate of rise did not change. In summary, in patients with isolated lower airways, end expiratory occlusions prolonged inspiratory efforts and DIA EMG. These findings indicate that during normal breathing volume-related afferents shorten inspiration in children. Isolation of lower airways suggests that these reflexes are not mediated by upper airway mechanoreceptors. Thus, the Hering-Breuer reflex may be present beyond the neonatal period. (Supp. NIH HL31173 and HL25830)

- †1864 DOSE RESPONSE CURVES TO COLD AIR CHALLENGE (CACH) IN CHILDREN WITH ASTHMATIC AIRWAY HYPERREACTIVITY. Maximilian S. Zach, Hanhannelore Kump, George Polgar (Spon. by Wayne State Univ., Children's Hospital of Michigan, Detroit, USA)

A previous study of CACH in asthmatic children produced indirect evidence of a reaction plateau (Zach et al., *Pediatr Res* 18:469, 1984). In order to directly examine this phenomenon, nine boys and 8 girls (mean age 13 6/12 years) were challenged by isocapnic hyperventilation of -10°C air at 75% of MVV for 10 minutes. Each minute FEV₁ and V_{max25%VC} were measured. During recovery these measurements were repeated every minute for 10 minutes. The table presents a summary of results:

	baseline	max. change	max. reaction (absolute)
FEV ₁ (%pred.)	80.8±15.4	27.8±11.8	52.8±18.6
V _{max25%VC} (%pred.)	48.2±27.3	27.0±16.3	21.2±18.8
	p <0.001	NS	P <0.001

The reaction plateau for V_{max25%VC} was reached somewhat earlier than for FEV₁. This, the more abnormal baseline and lower absolute value at maximum reaction for V_{max25%VC}, with comparable maximum changes for both tests, indicate a dose response markedly influenced by the baseline small-airway obstruction. By identifying a reaction plateau CACH offers a new parameter for outlining the individual dimensions of airway hyperreactivity in children with asthma.

- †1862 AGE-RELATED EFFECTS OF SURFACE TENSION ON LUNG FUNCTION DURING EARLY DEVELOPMENT. M.R. Wolfson, N. Tran, V. Bhutani, D. Rubenstein, T.H. Shaffer. (Spon: W.W. Fox). Temple Univ. Sch. of Med., Dept. of Physiology, Pennsylvania Hospital, Philadelphia, Rolling Hill Hospital, Elkins Park, Pa.

To study the effect of surface tension (ST) on lung mechanics during early development, *in vivo* pressure-volume and lung compliance/kg (C_L) determinations were made in preterm lambs. GR I (n=31; 122-140 days gestation; 2.25-3.90 kg BW) were gas ventilated and GR II (n=14; 106-138 days gestation; 1.10-3.40 kg BW) were liquid ventilated with oxygenated fluorocarbon (RIMAR 101). After effective ventilation (PaO₂>60 mmHg; PaCO₂=30-45 mmHg) and acid-base status (pH=7.25-7.45) were achieved, pulmonary function was evaluated (30-60 mins postnatally). Regression analysis showed significantly different relationships between C_L and age for GR I (r=0.95; p<0.001) and GR II (r=0.99; p<0.001). Whereas C_L for GR II consistently exceeded that for GR I, this difference did not become significant until after 125 days gestational age (GA). These data indicate that minimizing interfacial ST has little effect on C_L in animals <125 days GA, thereby suggesting that morphologic and tissue properties predominate surface properties in limiting lung distensibility at this early age. By defining the stage of development in which pulmonary function is most effectively improved by reduced ST, these findings suggest age-related criteria regarding the benefit of exogenous surfactant replacement therapy. (Supported by NIH Grant HL/HD 30525).

- †1863 THE EFFECT OF UPPER AIRWAY NEGATIVE PRESSURE IN INSPIRATION (EARLY VS LATE) ON THE BREATHING PATTERN. Diane L. Woodall, Mark L. Clark and Oommen P. Mathew (Spon. by D.K. Rassin), Department of Pediatrics, University of Texas Medical Branch, Galveston, Texas.

During normal inspiration the upper airway is subjected to negative pressure variations. For negative pressure to play a role in the control of breathing on a breath to breath basis it should be most effective in early inspiration. We tested this hypothesis by applying negative pressure to the upper airway in early (<200 msec) and late (>200 msec) inspiration. Multiple trials were conducted in 8 spontaneously breathing anesthetized tracheostomized adult rabbits while recording the diaphragm electromyogram. The values for the breath in which the negative pressure was applied were expressed as % of control (mean of 3 preceding breaths). When negative pressure was applied in early inspiration, the inspiratory duration (Ti) became prolonged (mean 111.4 ± 4.4 S.D.), the peak diaphragm activity (PDi) remained unchanged (97.8 ± 3.3), and the mean slope (PDi/Ti) decreased (85.8 ± 4.2). In contrast, when negative pressure was applied in late inspiration, the changes were minimal (Ti 95.3 ± 5.2; PDi 99.6 ± 4.9; PDi/Ti 102.6 ± 6.7). These results suggest that the influence of laryngeal afferents on the breathing pattern depends on the central sensitivity which appears to be changing during the respiratory cycle. The effect of negative pressure is maximal during early inspiration and decreases subsequently. Supported by grants from NIH (HL-01156) and (HL-32921-01).

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