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PHARYNGEAL PRESSURE DURING NASAL CPAP. H.W. Chilton and J.G. Brooks, Dept. of Perinatology, Children's Hospital and Dept. of Pediatrics, Univ. Colo. Med. Center, Denver, Colorado. (Spon. by L.J. Butterfield).

The pressure in an infant's airway when CPAP is delivered by nasal prongs has not been previously reported. Using air-filled catheters and differential pressure transducers we have measured simultaneous pressures in nasal prongs (P_{pr}) and pharynx(P_{px}) in 18 newborns. After a steady state was achieved, end expiratory pressure in five consecutive breaths was measured: these were usually identical but otherwise were averaged. The pressure difference ($P_{pr}-P_{px}=\Delta P$) was low in infants with visual evidence of tight palato-glossal apposition. Though there was much variation, babies whose mouths were a) spontaneously open without tongue/palate seal had a $\%\Delta P=48\% \pm 4\%$ (weighted average $\pm$ SEM), b) spontaneously closed or who had a demonstrable seal had a $\%\Delta P=8\% \pm 3\%$; these are significantly different means ($p=<.001$). In the latter group there was a close correlation between P_{pr} and P_{px} ($r=0.965$). The ability to maintain a good seal was not related to gestational age, post natal age, severity or type of disease. However, babies who maintained a good seal frequently had an active gag reflex (Fisher's exact test p=.04). Spontaneous closure of the mouth usually indicated a good seal but forcible closure did not consistently decrease the pressure drop.

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FACTORS LIMITING EXERCISE TOLERANCE IN CHILDREN WITH CYSTIC FIBROSIS (C.F.).A.L.Coates, D.Muller,M.Mearns, and S.Godfrey. Hammersmith Hospital and Queen Elizabeth Hospital for Children, London, England.

Godfrey and Mearns have shown that exercise intolerance in children with C.F. is related to airway obstruction. Recently Campbell et al suggested that poor nutrition leads to abnormal serum lipids which may lead to tissue hypoxia. Our study investigated the roles of hypoxia, lung mechanics, nutritional status and serum lipids in limiting exercise tolerance. Twenty children with C.F. of varying severity performed two progressive exercise tests on a cycle ergometer, once breathing air, once O_2. The body mass percentile,(BMP), as a measure of appropriateness of weight for height, was calculated from the body mass index.Serum lipids, maximal mid-expiratory flow rate (MMF) and maximum voluntary ventilation were measured. In five, end tidal CO_2 ($PETCO_2$) was monitored throughout the test. O_2 had very little effect on the work accomplished by each child. The mean percent work expected from height (Wmax) was 75 and the heart rate at the final work load was 175/min.,20 less in normal children suggesting adequate cardiovascular reserve at the final work load. Wmax correlated with the MMF,the BMP and the Shwachman score. The children with the lower MMF's had little respiratory reserve at the final work load. Despite this,no child at any time had an elevated $PETCO_2$. Serum lipids,while abnormal in every case,did not correlate with any parameter measured.We conclude that nutritional status and airway obstruction are closely correlated with exercise tolerance in C.F. and that,unlike the adult with chronic disease,exercise limiting dyspnea occurs with a normal $PETCO_2$.

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RELATIVE INCREASE IN SATURATED LECITHINS IN PROLACTIN-TREATED FETAL LUNG CULTURES. M.A. Cox, and J.S. Torday (Spon. by H.W. Taeusch, Jr.) Harvard Medical School, Department of Pediatrics, Boston, MA.

Fetal lung maturation is typified by independent increases in both lecithin (TL) and disaturated lecithin (DSL). A recent in vivo study (Hamosh, M., and P. Hamosh, J.C.I. 59:1002, 1977) has suggested that administration of prolactin (ovine NIH) to fetal rabbits can cause similar changes in lung phospholipid metabolism. We have studied the effect of prolactin on the production of TL and DSL by 28-day fetal rabbit lung cells in tissue culture. At confluence the cultures were incubated with ovine prolactin (Sigma, 22 IU/mg) for 24 hours and subsequently incubated for 6 hours with tritiated choline.

	Prolactin (μg/ml)	Lecithin ($\bar{X}\pm$SE) (pmol/flask)	DPL ($\bar{X}\pm$SE) (pmol/flask)	Saturation of lecithin (%)
Control	0	1040.0±34.5	115.5±20.0	11%
Treated	10.0	815.5±61.6	195.8±28.7	26%

There was a significant increase in DSL($p < .05$) without a detectable change in the amount of TL produced, resulting in a marked rise in the percent saturation. This is the first reported observation in vitro that production of DSL and TL can be independently regulated. In contrast, other regulators of surfactant synthesis (eg, T_4, glucocorticoids) increase TL and DSL production without changes in % saturation. The experiment was repeated using a single batch of prolactin (ovine NIH)without any demonstrable effect, which suggests caution is needed in attributing the response to prolactin.

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COMPARISON OF CHEST PHYSIOTHERAPY TECHNIQUES IN INFANTS WITH HMD. Crane,L.D.,Zombek,M.,Krauss,A.N.,Auld, P.A.M. Perinatology Cent., Dept. Pediat. N.Y.Hosp.-Cornell Med. Center, New York, N.Y. 10021.

Measurements of arterial blood gases,heart rate,respiratory rate,blood pressure,and transcutaneous O_2 were made during chest physiotherapy administered to 24 infants with hyaline membrane disease (HMD). These infants weighed between 650 and 3345 gm at birth. Three infants were maintained in oxyhoods; 5 received nasal CPAP; the remainder had endotracheal tubes when studied. Comparisons were made between postural drainage with tilt and vibration (A);vibration without tilt(B); tilt and percussion (C); and percussion without tilt(D). Therapy included physical therapy for 3-5 minutes followed by 5-10 breaths of 100% O_2 and airway suction. These techniques resulted in a statistically significant increase in heart rate,respiratory rate and systolic pressure in all groups. Values for transcutaneeous O_2 were above control levels following treatment but were not significantly different. With the exception of higher systolic pressure for infants treated in the head-down position, no statistically significant differences were observed between the four modes of treatment used. Apnea and bradycardia were not encountered with the technique described. Careful monitoring during physiotherapy is associated with adequate cardiovascular function, and no significant differences could be demonstrated between 4 commonly used modes of physiotherapy in terms of their effects on oxygen levels in infants with HMD.

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RESTRICTED FLUID THERAPY IN THE RESPIRATORY-DISTRESS SYNDROME (RDS). N. Desai, T. Pauly, G. Johnson, C. Cottrill, D. Cunningham, J. Noonan. Dept. Ped., U. of Kentucky, Lexington.

Standard fluid therapy recommendations may contribute to the occurrence of significant patent ductus arteriosus (PDA) and bronchopulmonary dysplasia (BPD) in RDS. Fluids given to 83 infants with RDS were limited in volume to meet only estimated insensible fluid loss; infants 1501-2400gm (N=59) received 25 cc/kg/da and infants 800-1500gm received 45 cc/kg/da (N=24). Additional fluids were administered if radiant warmer and/or phototherapy were used. 16/24 (66%) and 18/59 (30%) required mechanical ventilation. Adequate urine output was demonstrated in infants >1500gm by a mean volume ratio of fluid input/urine output (I:O) of 1.06 (0.65-1.50); for infants <1500gm I:O equaled 1.17 (0.8-1.6). Infants in both groups had normal urine specific gravity; mean 1.012 (1.002-1.018). All 83 infants maintained normal hematocrit and serum Na, K, Cl, and glucose. All infants lost weight during the first 48 hours: mean body weight loss was 5% (0.8-8.8%). PDA was diagnosed on the basis of heart murmur, bounding pulses, and echographic LA/Ao ratio $\geq$1.2:1; incidence was 7.2% (6/83). BPD was diagnosed by radiographic findings and persistence of increased $A\text{-}aDO_2$ and CO_2 retention; incidence was 2.4% (2/83). Six infants died (mean birth wt 1010gm): intracranial hemorrhage 3, meningitis 1, digoxin toxicity 1, airleak syndrome 1. Conclusions: 1) infants with RDS can maintain fluid homeostasis despite restriction; 2) fluids limited to meeting only insensible losses may minimize the occurrence of PDA and BPD.

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ACTIVE EXPIRATORY WORK OF BREATHING IN THE NEWBORN. Robert Dinwiddie, George Russell, William W. Fox. (Spon. by Jean A. Cortner), University of Aberdeen, Scotland and the Univ. of Pa. Sch. of Med., Dept. of Peds. and The Children's Hospital of Philadelphia, Philadelphia, PA.

The small lung volume and low total lung compliance of the newborn lung leads to a different pattern of respiration from that of the older child and adult. Respiratory rates are higher and inspiration-expiration times shorter in order to maintain adequate alveolar ventilation. These parameters are best mediated through a work of breathing pattern which requires active expiratory mechanical work in order to prevent air trapping and to stabilize resting lung volume. Transpulmonary pressure (esophageal balloon), air flow (pneumotachograph), and tidal volume enabled determination of dynamic pressure volume loops. Expiratory work of breathing was studied by planimetry on pressure-volume diagrams obtained from 100 normal newborn infants in the first three days of life. Mean birthweight was 3.39 kg (range 2.91-5.26 kg.), gestational age 38.6 wks. (range 37-42 wks.). Dynamic lung compliance was 1.68 $\pm$ 0.06 ml/cm H_2O/kg mean $\pm$ S.E., resting lung volume 26.1 $\pm$ 0.7 ml/kg, respiratory rate 49 $\pm$ 1 per min., total work of breathing 32.7 $\pm$ 0.4 gm/cm/kg and active expiratory work per breath 2.9 $\pm$ 0.3 gm/cm/kg. Active expiratory work was performed in 98% of infants studied. It is concluded that active mechanical work is required even in the normal newborn during quiet respiration in order to overcome the resistive forces to expiration and that insufficient potential energy is stored during inspiration to perform this passively.