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THE EFFECTS OF DIFFERENT BODY POSITIONS ON PULMONARY FUNCTION IN NEONATES RECOVERING FROM RESPIRATORY DISEASE. Marcia J. Wagaman, John G. Shutack, Ara S.

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To evaluate alterations in pulmonary function with positioning, 9 intubated neonates (wt. [mean] 2.3 kg., gest. age 34 wks., FiO_2 .29, CPAP or PEEP 4 cm H₂O) were studied in 4 positions (SC=supine control, PR=prone-abdomen restricted, PF=prone-abdomen hanging free, SF=supine followup). After 30 min. in each position; arterial blood gases, lung mechanics, and funct. residual cap. (FRC) were measured. Mean values in supine control were: pO_2 67 torr, pCO_2 42 torr, RR 54 breaths/min., lung compliance (CL) 1.7 ml/cm H₂O, tidal volume (VT) 4.15 cc/kg, minute ventilation (\dot{V}_E) 263 ml/kg/min, FRC 26 ml/kg. In PR compared to SC: pO_2 increased 12 torr (mean); FRC decreased 15%. In the PF compared to SC: pO_2 increased 15 torr, mean FRC was unchanged but increased in 5/8 pts. In PF compared to PR: pO_2 increased 6 torr; mean FRC was unchanged but increased in 5/7 pts. All comparisons of CL, pCO_2 , \dot{V}_E between the above groups were unchanged. In SF compared to PF: pO_2 decreased 9 torr, FRC decreased 27%, CL decreased 44%, pCO_2 was unchanged, \dot{V}_E decreased 20%. Summary of trends: 1) compared to supine control pO_2 increased in both prone positions and FRC decreased in prone-abdomen restricted; 2) PF was better of 2 prone positions for increasing FRC. This study demonstrates that prone positioning improves oxygenation in neonates and that the prone-abdomen free is the best prone position for increasing lung volumes in infants with respiratory disease.

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DEFICIENT BARORECEPTORS IN INFANTS WITH HMD. Waldman S., Krauss, A.N., Auld, P.A.M. Perinatology Cent., Dep. Peds., N.Y. Hosp.-Cornell Med. Cent. New York, N.Y.

Transition from recumbent to erect position results in a fall in limb blood flow in the dependent extremity, increase in local vascular resistance, and tachycardia (baroreceptor response). A 45° head-up tilt was used to elicit this response in 13 healthy premature infants ranging in weight from 780-2340 gm; 14 mildly distressed infants with HMD who had normal arterial blood gases in less than 60% O₂; and 13 severely ill infants who had an arterial pH below 7.25 and required over 60% O₂. All were studied between 1 and 3 days of age. Non-distressed infants had a fall in blood flow in the dependent extremity of 41±53% of resting value when tilted to a 45° head-up position. Moderately sick HMD infants demonstrated a rise of 96±190% of resting values; severely sick infants demonstrated a rise of 129±167%. Only 2/27 sick infants demonstrated a normal fall in limb blood flow. Five sick infants who failed to decrease limb blood flow during tilt had peripheral vascular resistances at rest of up to 3 times upper limits of normal. A significant tachycardia was not seen in either sick or well infants. These findings suggest that (1) a complete baroreceptor response is not present in pre-term infants; (2) healthy pre-term infants can alter peripheral vascular tone, while this ability is often lost in infants with HMD; (3) some apparently "unresponsive" infants have already significant increases in vascular resistance in response to their illness and are incapable of further compensations in response to tilt.

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PERIPHERAL BLOOD FLOW AFTER TRANSFUSION IN INFANTS WITH HMD. Waldman S., Krauss, A.N., Auld, P.A.M. N.Y. Hosp., Cornell Med. Cent. Perinatology Cent. Dept. of Pediatrics, New York, N. Y. 10021.

15 infants were studied before and after transfusion of 10 cc per kg of packed RBC (8 infants) or 5 cc/kg of 25% salt-poor albumin (8 infants). Measurements were made immediately before and 1 hour after transfusion and included aortic blood pressure, PaO_2 , PaCO_2 , pH, arterial lactate, arterial/alveolar O₂ ratio, and limb blood flow. Indications for transfusion included observed blood loss, anemia, low blood pressure, and metabolic acidosis. Significant changes, pre- vs post- transfusion, paired t-test, with $p < 0.05$ (*) were:

	Packed RBC	25% Albumin
Arterial PaO_2 , mm Hg	+ 34 *	+ 24
Arterial PaCO_2 , mm Hg	- 11 *	- 1
Arterial pH, units	+0.06	+0.03 *
Arterial/Alveolar O ₂ ratio	+0.07	+0.06 *
Limb blood flow, cc/min/100ml	+2.8 *	+2.9
Mean aortic pressure, mm Hg	+ 8 *	+ 3
Arterial lactate, mEq/L	+1.2	+ 3 *
Hematocrit, %	+ 1	+ 4

No correlation was seen between standard clinical measurements and the response to therapy, suggesting they do not accurately indicate the severity of shock in sick neonates. Transfusions were effective at improving peripheral blood flow in these infants. The post-transfusion rise in lactate suggests the existence of a sequestered pool of acid accumulated when limb blood flow is reduced during the course of illness.

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INTERACTION OF SUBSTRATE OXIDATION AND PHOSPHOLIPID SYNTHESIS IN DEVELOPING LUNG. Joseph B. Warshaw and Mary L. Terry. Yale University School of Medicine. Department of Pediatrics, New Haven, CT.

The developing lung is dependent on substrate availability to support both growth and the specialized synthetic pathways of surfactant phospholipid (PPL) synthesis. We have investigated fatty acid (FA) oxidation in developing lung and have examined interactions between glucose and FA oxidation and pulmonary lipid synthesis during fetal and newborn development. Oxidation of capric acid (10 carbons) decreased between 17 and 21 days of fetal development but showed a marked increase on the first postnatal day. Palmitate oxidation showed a similar postnatal increase but oxidative rates were lower. At one day of age capric acid oxidation was 20% that of glucose oxidation. Triglyceride and PPL synthesis from palmitate by lung slices paralleled the postnatal increase in FA oxidation. There was an inverse relationship between FA oxidation and increasing FA chain length with highest oxidative rates seen with caprate and lowest rates with palmitate. This was not influenced by the addition of carnitine to the medium. There was a direct relationship between increasing FA chain length and incorporation into lung lipids. Palmitate was the FA most actively incorporated. These data suggest that while FA can be actively oxidized by newborn lung, long chain fatty acids may be utilized preferentially for PPL synthesis rather than as oxidative substrates. Metabolic change in developing lung may influence substrate and energy availability and the course of surfactant production.

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DEPRESSED VENTILATORY RESPONSE IN OCULOCRANIOSOMATIC NEUROMUSCULAR DISEASE (OCS). Tzong R. Weng, Gary E. Schultz, Michael Nigro, Zwi Hart, George Polgar.

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We studied ventilatory responses to progressive hypoxia and CO₂ rebreathing on 3 sisters with OCS on 4 or more occasions each. Oxygen consumption (\dot{V}_{O_2}) was determined by spirometry and analysis of mixed expired gas. The CO₂ response was quantified by the slope "S" (\dot{V}_E/PACO_2) in the equation $\dot{V}_E = S(\text{PACO}_2 - B)$ where B is the extrapolated PACO_2 at zero minute ventilation (\dot{V}_E). Response to hypoxia was expressed as $\Delta \dot{V}_{40}/M^2$ which is the increase in \dot{V}_E when alveolar P_{O_2} was decreased normocapnically from >150 to 40 mmHg, divided by body surface area. Low values for S or $\Delta \dot{V}_{40}/M^2$ signify depressed responses. Control values were obtained in 8 normal subjects (4 male, 4 female). Results:

Patients	Age (yrs)	$\Delta \dot{V}_{40}/M^2$ (L/M ²)	S	\dot{V}_{O_2} (STPD) (ml/min)
LS	16	2.0	0.60	≥0-188
KS	13	3.1	0.94	192-218
DS	10	3.8	1.34	202-220
Controls	24-42	5.7-18.3	1.80-3.75	-

This is the first report of familial OCS with markedly decreased ventilatory response in 3 sisters. The ventilatory response decreased with advancing age and clinical progression. In the most severe case (LS) the \dot{V}_{O_2} was unsteady, at times approaching zero, and varied from day to day. We conclude that there is a progressive desensitization of chemoreceptors in OCS which may in part be related to an altered metabolic state.

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ATELECTASIS (ATL) IN THE INTUBATED NEWBORN WITH HYALINE MEMBRANE DISEASE (HMD) Jonathan M. Whitfield and M. Douglas Jones, Jr., The Newborn Center, The Children's Hospital, Denver, Colorado (Spons. by William H. Zinkham, M.D.)

A total of 162 episodes of ATL occurred in 58 of 166 consecutive infants ventilated for HMD with the Baby Bird infant ventilator. 48 of 73 infants <1500 grams and 87 of 93 infants >1500 grams survived. In 10 patients ATL occurred during intubation only (Type I); in 19, both during intubation and after attempted extubation (Type II); and in 29, after attempted extubation only (Type III). The incidence of ATL was significantly ($P < .01$) related to birthweight (34/73 <1500g (Group A); 25/93 >1500g (Group B)). Type II was frequent in Group A (17/34), whereas Type III was more common in Group B (19/25). The most important variable was the length of time of intubation. ATL was extremely rare in either Group if initial intubation was <5 days. On the other hand, it was found in 22/27 infants whose initial intubation was ≥14 days (89 episodes). "Initial" intubation is contrasted with re-intubation for respiratory distress consequent to atelectasis. One or more re-intubations were necessary in 16 of 34 infants in Group A and 7 of 25 in Group B. Thus, atelectasis resulted in considerable morbidity. The right lung was involved in 83% of episodes (33% involved the right lower lobe). Tracheobronchial suctioning causes disproportionate damage to the right mainstem bronchus, and these infants were suctioned hourly. The predominance of right-sided ATL suggests that suctioning procedures in neonates should be critically studied.