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NEW STANDARDS FOR "BASAL" HEAT PRODUCTION AND EVAPORATIVE AND NON-EVAPORATIVE HEAT LOSS IN LOW BIRTH WEIGHT NEWBORN INFANTS? A. Okken, J.H.P. Jonxis, P. Rispen, and W.G. Zylstra. From the Dept. of Pediatrics State University, Groningen, Netherlands (Spon. by M. Klaus)

Recent reports indicate that both heat production and heat loss in low birthweight infants in incubators exceed the "basal" values. This is thought to be a result of non-optimal environmental conditions in the incubator. To study this we measured both heat production and evaporative and non-evaporative heat loss simultaneously in resting newborn infants in a metabolic chamber at neutral air and wall temperature, moderate humidity and low air velocity. A total of 100 measurements were obtained in 30 newborn infants (birthweight 0.88-2.88 Kg) during the first two weeks of life.

Results for the first week of life are shown in the table.

Birthweight Kg	Heat Production Kcal/Kg/d	Evap. Heat Loss Kcal/Kg/d	Non-Evap. Heat Loss Kcal/Kg/d
0.88-1.25	51.3±4.7	31.4±7.8	19.9±5.4
1.25-1.75	45.9±7.0	21.0±7.2	24.9±10.2
1.75-2.25	47.9±7.0	13.0±3.6	34.9±5.5
2.25-2.88	47.5±2.7	11.2±1.5	35.5±2.7

In the very low birthweight infants evaporative heat loss proved to be surprisingly high. Resting heat production in all weight groups was consistently 20-30% higher than the "basal" values reported previously. The increase in caloric intake that has occurred from 1968 to 1976 might explain the increased heat production. We suggest that standards for "basal" heat production and heat loss should be re-evaluated.

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OXYGEN CONSUMPTION OF INFANTS UNDER INFRARED RADIANT ENERGY WARMERS. AMIL ORTIZ, RICHARD P. KNUDSON, ERROL R. ALDEN, WARREN H. TOEWS, MAMC, DEPT OF PEDIATRICS, TACOMA, WA, SPONSORED BY WILLIAM A. HODSON.

Overhead radiant warming devices facilitate the care of sick newborn infants. However, no data are available on the energy expenditure (oxygen consumption) of infants under radiant energy warmers compared to conventional incubators. This study was conducted to compare oxygen consumption of normal, two day old full term infants subjected to non-ionizing radiant warmers (KDC-CC-660) and to conventional incubators (Servo-Care Armstrong Incubators, Ohio Medical Products). Oxygen consumption was determined using the "closed system technique" employing nasal prongs, a CO₂ analyzer the Beckman OM-11 O₂ analyzer and the Hewlett Packard (HP) Pneumotach with attachments to the respiratory integrator of the HP 7700 multichannel recording system. All infants were fed 20 minutes prior to each recording period. Each infant was alternately placed on the radiant warmer and the incubator (servo-control set to 36.5°C) and after an initial stabilizing period of 20-30 minutes the O₂ consumption was determined for 3-5 minutes while in quiet sleep (characteristic EEG, ECG, muscle activity and respiration).

	Warmer VO ₂ cc/kg/min	Incubator VO ₂ cc/kg/min	% Difference
n			
Means±SD			
8	6.01±0.4	5.09±0.33	14.98±2.31

The skin temp and heart rate were respectively, radiant warmer 36.6°C and 136 b/m and incubator 36.1°C and 135 b/m. These findings support the hypothesis of increased oxygen consumption in infants on radiant energy warmers.

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GLUCOSE INFUSION FOR THE PREVENTION OF BILIRUBIN TOXICITY IN THE NEONATE: THE ROLE OF FREE FATTY ACIDS (FFA). Enrique M. Ostrea, Jr., Andres E. Bartos, Cheryl A. Fleury, C. Antonio Jesurun. Wayne State University and Hutzel Hospital, Department of Pediatrics, Detroit, Michigan

The jaundiced neonate is at risk to bilirubin toxicity if its serum albumin has a diminished capacity to further bind bilirubin as indicated by a high saturation index (SI) of $\geq 8\%$ (J Pediatr 76:12, 1970). This study reports 8 jaundiced infants (T. Bil = 13.8 ± 1.8 mg%) with high SI ($8.4 \pm 0.8\%$) and no hemolytic disease or drug intake. The infants were 2-4 days old and were either feeding poorly on formula or insufficiently on the breast with glucose water supplement. Glucose infusion was given at a rate of 1 g/kg/h for 2 hours. After the infusion, there was a significant fall ($p < 0.05$) in the SI ($\Delta = -4.6\%$) and total serum FFA ($\Delta = -3.4$ mEq/L). These changes were not secondary to simple dilution since there was no associated significant fall ($p > 0.10$) in the bilirubin ($\Delta = -1.1$ mg%) or serum protein ($\Delta = -0.15$ g%) concentrations.

The composition of the serum FFA was further analyzed by gas-liquid chromatography and it was observed that the SI was predominantly influenced by the unsaturated FFA level. The fall in the SI ($\Delta = -4.6\%$) correlated significantly ($p < 0.05$) with the fall in concentration of palmitoleic ($\Delta = -1.13$ mEq/L, $r = 0.82$) and oleic ($\Delta = -1.48$ mEq/L, $r = 0.68$) acids but not with lauric, myristic, palmitic or stearic acids ($p > 0.10$).

CONCLUSION:

Our study indicates that the risk to bilirubin toxicity in any jaundiced infant who is feeding insufficiently should be immediately identified since treatment by glucose is both simple and effective. In particular, the jaundiced infant is at risk if breast fed prior to the normal flow of mother's milk. Since all the breast fed infants in our series who had high SI were being supplemented with oral glucose water after each breast feeding, our findings further indicate that this measure may not be effective in reducing the risk to bilirubin toxicity.

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PERIPHERAL MEDIAN NERVE DAMAGE SECONDARY TO BRACHIAL ARTERIAL BLOOD GAS SAMPLING: Karen E. Pape, Dawna L. Armstrong, Pamela M. Fitzhardinge. Univ. of Toronto, Research Inst., Hosp. for Sick Children, Toronto, Canada.

In 1974, 252 infants with birth weights < 1501 g were referred to our neonatal intensive care unit. Arterial blood gases were monitored frequently to avoid the complications of hypo- and hyperoxia. Umbilical catheters were removed after 4 to 5 days; further arterial sampling was obtained preferentially from the right brachial artery. Eighty-nine percent (146/167) of the survivors have been examined prospectively to the age of 18 months post-term. Evidence of peripheral median nerve damage with mild to moderate impairment of the pincer grasp was found in 18 infants (12%). All had visually obvious scarring in the antecubital fossa secondary to arterial punctures. The right median nerve alone was affected in 13 cases; bilateral damage occurred in 5. The incidence of this lesion varied directly with the frequency of peripheral arterial punctures and indirectly with birth weight. An examination of autopsy tissue blocks of the antecubital fossa taken from 6 similarly treated infants revealed 4 with varying degrees of hemorrhage dissecting tissue planes. The most severe lesion demonstrated repeated extensive bleeding, muscle necrosis and a traumatic neuroma. A well defined pincer grasp is expected to be present by 12 months post-term; by 18 months post-term all peripheral regeneration of damaged nerve fibers should be completed. These results suggest that brachial arterial punctures may be associated with median nerve damage in the pre-term infant.

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RESUSCITATION OF PRETERM INFANTS WITH EARLY POSTNATAL CARDIOVASCULAR SHOCK, Charles L. Paxson, Jr., Peggy Rapoport, David Bolam, and Yoshio Miyazaki, U. of Nebraska Coll. of Med., Omaha, (Spons. by G. C. Rosenquist).

This study was designed to evaluate the vascular compartment of infants born in the presence of maternal vaginal bleeding, and to describe one regimen for fluid and pharmacologic resuscitation. Eleven infants born to mothers with abruptio placentae exhibiting tachycardia (HR > 150) and hypotension at 1 hr. age received empiric infusions of 20 ml/kg lactated Ringers solution (LR) and 20 ml/kg fresh blood. Blood volume (BV) determinations using the 51Cr RBC dilution technique were completed and BV deficits were then corrected by rapid transfusions of fresh blood. BV determinations were repeated and infants were given 1 µg/kg per min. continuous infusion of Dopamine if BV was normal and hypotension persisted.

Eleven infants were studied and BV were markedly deficient as reflected in the mean red cell volume of 35 ml/kg ($n = 64$), and mean total BV of 67 ml/kg ($n = 108$). Two infants were infected (Group B strep, E. coli), and 2 infants remained hypotensive following BV restoration with a second transfusion. The infant with Strep infection and 1 infant given Dopamine expired.

We conclude that preterm infants with hypotension resulting from abruptio placentae are markedly volume deficient and that proper management of these babies required BV determinations. Although early resuscitation with LR is efficacious (survival = 82%), treatment with Dopamine requires further evaluation.

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FAILURE OF CONVENTIONAL RESPIRATORY MONITORING TO DETECT HYPOXIA. J.L. Peabody*, G.A. Gregory, M.M. Williams*, J.F. Lucey*, and W.H. Tooley. Univ. of Calif., Cardiovas. Res. Inst., Depts. of Ped. & Anes., San Francisco, and Univ. of Vt. Coll. of Med., Dept. of Ped., Burlington.

Fig. 1. A 40 second period of apnea with intermittent breaths. The tcPO₂ fell to 20 torr but neither the heart or respiratory sensor alarmed.

We studied 21 preterm infants (550-1870 gms and 27-34 wks gestation) who had recurrent apnea. For 145 hrs in periods of 2-7 hrs we continuously monitored transcutaneous oxygen tension (tcPO₂) relative blood flow, heart rate and thoracic impedance. Nasal air flow was monitored with a thermistor on 8 occasions. We recorded tcPO₂ during 544 periods of apnea ≥ 15 sec. The tcPO₂ fell to below 40 torr during 178 apneic periods. Only 64 of these episodes activated the apnea alarm (set to respond after 15 secs. of apnea). The heart rate alarm (set to alarm at 100 beats/min) was activated in only 108/178 (Fig.1). We conclude that conventional methods of respiratory monitoring are poor detectors of hypoxia due to apnea.