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OUTCOME OF MECHANICALLY VENTILATED INFANTS WITH CYSTIC FIBROSIS (CF) AND RESPIRATORY FAILURE. Youn Chan, Jeffery S. Garland, Richard B. Berens, Kevin J. Kelly, Thomas B. Rice (Spon. by S. Werlin). Medical College of Wisconsin, Children's Hospital of Wisconsin, Department of Pediatrics, Milwaukee, WI.

Previous studies have documented a 75-85% mortality rate in infants (<12 mos.) with CF who initially presented with respiratory failure requiring mechanical ventilation (RFMV). Five infants with CF and RFMV as their initial presentation were cared for between the years 1980-86 at Children's Hospital of Wisconsin. Clinical presentation of each case (age, physical exam, ABGs, CXR findings, tracheal cultures, days ventilated) was similar to previously reported studies of infants with CF and RFMV. The purpose of this study was to compare the outcome of these infants with age matched CF infants who never had RFMV.

Three age matched controls with CF and born between the years 1980-86 were selected at random for each case. Most recent Schwachman's scores (SS) were obtained independently by two investigators. Interobserver differences in SS were not significant. All study cases were alive from 1-6 years after the episode of RFMV. Their most recent mean SS was 82.0 (range 79-95). In comparison, the recent mean SS of the controls was 78.0 (range 50-95). There was no difference between group SS ($t=0.54$, NS).

We conclude that the outcome of infants with CF whose initial presentation is RFMV is not as grave as once thought. If indicated, infants with CF and respiratory failure should be ventilated.

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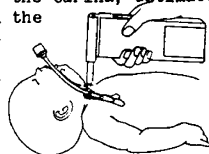
RELATIONSHIP OF PUMP FLOW RATE AND HEMOGLOBIN SATURATION TO INDICATORS OF SUFFICIENCY OF OXYGENATION DURING EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO) IN THE NEWBORN BABOON. J. Devn Cornish, Dale R. Gerstmann, Donald M. Null, Jr., Melvin D. Smith, Thomas J. Kuehl (Spon. By Gerald W. Fischer). Wilford Hall USAF Medical Center, Department of Pediatrics, San Antonio, Texas.

The minimum acceptable oxygen delivery and flow rates during neonatal ECMO remain to be defined. We have studied the relationship of perfusion flow rates and hemoglobin saturations to oxygen delivery (DO₂), oxygen consumption (VO₂), systemic oxygen pH, lactate, and bicarbonate concentration in neonatal baboons. The right internal jugular vein, right carotid artery, both femoral arteries were cannulated, and the ductus arteriosus, aorta, and pulmonary artery ligated. The paralyzed animal was intubated and endotracheal tube clamped. We measured Hb, pH, PaO₂, and PvO₂ (from the circuit), high internal jugular PvO₂, and pump flow; we calculated bicarbonates, saturations, DO₂, VO₂, SXO₂, and CXO₂. Six baboons were studied during each of two phases of the experiment. First, flow rates were varied from 200 to 50 ml/min/kg (30 min at each flow) with saturation maximized. Second, flow was maintained at 200 and saturation was serially reduced from 100% to 38% (30 min at each saturation). Results ($\bar{x} \pm SD$, ml/min/kg): VO₂ fell significantly below baseline at a flow rate of 50 and a DO₂ of 8^{±2} in phase 1 and at a DO₂ of 12^{±5} in phase 2. CXO₂ fell significantly at DO₂ of 16%. Flows of 50 ml/min/kg may provide adequate O₂ delivery for short periods of time, but flows <100 and DO₂ <17 may be inadequate over longer periods. O₂ extraction is reduced even at max. flows when Hb saturation is decreased.

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NONRADIOGRAPHIC, TRANSCUTANEOUS DETERMINATION OF TRACHEAL TUBE POSITION: RESULTS OF MULTICENTER PRECLINICAL EVALUATION. Robert K. Crone, Endla K. Anday, Desmond J. Bohn, Michael F. Epstein, Anne B. Fletcher, William W. Fox, Ivan D. Frantz, III, Russell C. Raphael, Ann E. Thompson, and William McCormick, Pediatric Research Collab., M.I.C.U. Office, The Children's Hospital, Harvard Medical School, Boston.

A new procedure for real time, nonradiographic determination of endotracheal tube position with a magnetic field interference sensing technique was evaluated in cadavers. Each prototype tube incorporates a magnetically detectable marker at a specific distance from its distal tip, which varies with tube size. Transcutaneous determination of tube position is accomplished with a portable instrument that emits visual and aural signals of intensity proportionate to the alignment and proximity of the instrument sensing probe with the tube's magnetic marker. In the pre-clinical studies the magnetic marker was positioned so that the maximum signal intensities were obtained when the instrument probe was located at the upper edge of the suprasternal notch. Studies were carried out in 25 cadavers adhering to the protocol utilizing six tube sizes. In each case radiographic analysis confirmed distal tip placement to be above the carina, estimated at the 4th/5th vertebral space, and within the middle third of the trachea below the suprasternal notch. We conclude that this method will reduce the need for X-ray confirmation of tracheal tube position in pediatric patients and that testing in living, intubated infants is warranted.



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ATRIAL NATRIURETIC PEPTIDE (ANP): THE RELATIONSHIP WITH VOLUME, TACHYCARDIA AND CRITICAL ILLNESS. Alan L. Davis, David S. Goldstein, Jose R. Salcedo, Karen Kuehl, and Murray M. Pollack (Spon. by Glenn C. Rosenquist). George Wash Uni Child Hosp Natl Med Ctr, Depts of Anesth, Card, Peds, Wash., D.C. and Hypert/Endoc. Br, NHLBI, NIH, Bethesda, Md.

This study examines the effect of volume overload, atrial heart rate and critical illness on ANP levels in children. ANP levels were measured in 7 children undergoing dialysis(D), 4 children undergoing cardiac catheterization with electrophysiological pacing(EP), and 4 children in the ICU with pulmonary artery (PA) catheters. Thirty-four children were controls. The ANP results (RIA technique) are expressed in pg/ml (mean \pm SD). ANP levels in all 3 study groups were significantly different from normal (6.5 \pm 4.9) as follows: pre D pts, 139.7 \pm 71.3 ($p < .001$); EP, 48.5 \pm 20.5 ($p < .02$); ICU patients, 104.0 \pm 44.9 ($p < .001$). Pre and post D samples were significantly different (139.7 \pm 71.3 vs. 90.7 \pm 50.6, $p < .004$) and the change in ANP was correlated with the percent weight loss ($R = .733$). Pacing increased heart rates (117 \pm 17 vs. 157 \pm 20, $p < .01$) and ANP levels correlated with the increase in heart rate (48.5 \pm 20.5 vs. 203.0 \pm 66.0, $p < .005$, $R = .66$). ICU patients had elevated but statistically equivalent ANP levels in central venous, PA and arterial samples. CONCLUSION: ANP levels are increased in children with fluid overload, elevated heart rates and in critical illness. Removal of fluid from volume overloaded patients directly correlated with a decrease in ANP. Pacing of the right atrium in children caused a significant elevation of ANP confirming the association of tachycardia with ANP.

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RESPONSE TO LOW CARDIAC OUTPUT (Q): DEVELOPMENTAL DIFFERENCES IN O₂ DEFICIT (O₂D) AND RECOVERY IN LAMBS. John T. Fahey and George Lister, Yale Univ. Sch. of Med., Dept. of Pediatrics, New Haven, CT.

When Q is critically lowered, whole body O₂ consumption (VO₂) falls and an O₂D accumulates. With restoration of Q, an excess VO₂ would be expected thus "repaying" some or all O₂D. We tested the hypothesis that young lambs, with higher resting VO₂/kg and Q/kg than older lambs, would repay less of their O₂D because they have a higher proportion of nonessential metabolism. We lowered Q acutely by inflating a Foley catheter in the right atrium in spontaneously breathing, sedated lambs at ages 2 (n=4) and 8 (n=4) weeks, while monitoring VO₂ continuously. Each lamb was studied with low Q for 30 and 60 min on different days. Aortic and pulmonary artery blood pressures, gases and O₂ saturations, venous hemoglobin, and arterial lactate (L) were measured every 10 min during baseline, low Q, and 60 min recovery. O₂D was calculated as the time integral of [VO₂ @ baseline - VO₂ @ low Q]. The average percent decreases in Q (66.5%, 64.5%) and VO₂ (32.5%, 35.2%) were similar in the 2 and 8 wk groups, respectively. We found at both ages that L increased linearly with time and with O₂D during low Q, yet there was no correlation between L and O₂ repayment during recovery. Moreover, there was no consistent relation between O₂D and O₂ repayment. However, on average the 2 week group repaid a significantly lower percentage (18 \pm 5%, $m \pm SEM$) than 8 week old lambs (90 \pm 32%). In fact, in 5 of 8 two week studies, the net payoff was negative, i.e. the recovery VO₂ was lower than the baseline VO₂ in spite of declining L throughout recovery. We conclude that 2 week old lambs might be less able to repay an O₂D incurred during low Q; alternatively, they have a higher proportion of nonessential metabolism which can be decreased during stress, a potential mechanism for survival during low Q.

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ADULT RESPIRATORY DISTRESS SYNDROME (ARDS) IN NEONATES: A CLINICAL SYNDROME? Roger G. Faix, Rose M. Viscardi, Michael A. DiPietro, Joanne J. Nicks (Spon. by SM Donn). Depts of Pediatrics, Radiology, Respiratory Therapy, University of Michigan, Ann Arbor.

Since 1984 we have cared for 11 neonates with severe respiratory distress whose clinical characteristics appear distinctive: 1) full-term by obstetric and Dubowitz criteria (median 39 wks, range 37-42; median BW 2950g, range 2610-4360), 2) diffuse alveolar disease radiographically, 3) requiring FiO₂ 1.0 and mechanical ventilation to maintain PaO₂ 50, 4) absence of other conditions known to produce a similar clinical profile. No mothers were diabetic or Rh-sensitized. Blood cultures and latex agglutination bacterial antigen studies were negative in all. None had aspirated meconium. Two-dimensional echocardiography and simultaneous pre- and postductal ABGs showed no evidence of cyanotic congenital heart disease or extrapulmonary right-to-left mix. Among the 11, 5 had 5 minute Apgar scores <5, 8 had evidence of fetal distress, 5 had initial hematocrits <45, and 7 had hypotension or oliguria requiring pressors and/or volume support. Seven had multiple organ dysfunction. All 11 survived but required prolonged mechanical ventilation and supplemental oxygen. Trials of hyperventilation (pH >7.55, PaCO₂ <25) in 8 and tolazoline in 4 failed to increase PaO₂ by >20 torr. Among 7 infants who underwent trials of increased PEEP to >6 cm H₂O (range 6-10) without other concurrent changes in ventilator settings, 6 responded with prompt increases in PaO₂ >20 torr (median 68, range 22-136), despite resultant mean airway pressure (PAW) being lower than previously unsuccessful PAWs in 4 of 6. We suggest that ARDS is a distinctive clinical entity in neonates. A trial of PEEP >6 cm H₂O should be considered in full-term infants with severe respiratory distress in whom other causes can be excluded.