212 PULSE OXIMETRY-ITS RELIABILITY IN PREDICTING ARTERIAL OXYGENATION Tzong J. Wei, Amelia Bautista, So H. Ko, Shyan C. Sun(Spon. Hugh Evans) UMDNJ New Jersey Medical Sch., Dept. Ped, Children's Hosp. of NJ Div. Neonatology, Newark, New Jersey

Pulse oximeter (Nellcor 100) was used to continuously monitor (via skin surface) 0_2 saturation ($TcS0_2$) in 26 neonates (GA 25-40 wks, BW 700-3500 gm) with cardiac or respiratory distress. First, we studied whether $TcS0_2$ reading would correlate with actual measurement of arterial 0_2 saturation ($Sa0_2$). Simultaneous deteriminations of $Sa0_2$ by OSM_3 hemoximeter (Radiometer) revealed a linear correlation of $TcS0_2$ and $Sa0_2$ with r=0.969 ($p<10^6$). Secondly, we obtained a correlation equation of $TcS0_2$ and $Pa0_2$ through simultaneous blood samplings (N=394): log $Sa0_2/100-Sa0_2$=-2.951+2.262 log $Pa0_2$. (r=0.871, p<0.0001). This equation was almost identical with fetal Hb 0_2 dissociation curve. We derived from these data the range of $TcS0_2$ (80% to 95%) to maintain $Pa0_2$ in the range of 40 to 80 torr. Finally using these criteria we studied the sensitivity and specificity of pulse oximetry by analyzing 394 paired $TcS0_2$ and $Pa0_2$ samples.

$TcS0_2$%	No.	$Pa0_2$>80 torr	$Pa0_2$80-40 torr	$Pa0_2$<40 torr
>95	44	22 (50%)	22 (50%)	0
<80	72	0	13 (18%)	59 (82%)
80-95	278	6 (2.1%)	254 (91.4%)	18 (6.5%)

Confining $TcS0_2$ in the range of 80 to 95% in order to restrict $Pa0_2$ within the limit between 40 to 80 torr revealed a sensitivity of 88% and specificity of 77%. Keeping 0_2 saturation in this range would overestimate $P0_2$ in 6.5% (18/278 $Pa0_2$ <40 torr) and underestimate $Pa0_2$ in 2.1% (6/278 $Pa0_2$ >80 torr) of determinations. Understanding its optimal range will enhance effectiveness in clinical practice.

213 TRANSCUTANEOUS 0_2 SATURATION VS 0_2 TENSION MONITORING. Tzong J. Wei, Huey C. Tien, Anita Baldomero, Amelia Bautista, Shyan C. Sun (Spon. Franklin Behrle), UMDNJ-New Jersey Medical School, Dept. Ped. Children's Hospital of NJ, Div. Neonatology, Newark, NJ

A new mode of continuous 0_2 surveillance (pulse oximetry) is rapidly gaining popularity over traditional transcutaneous $P0_2$ monitoring in this country. Both techniques continuously and transcutaneously monitor oxygenation status - one monitors 0_2 saturation while the other 0_2 tension: we compared the two techniques ($TcS0_2$ by Nellcor pulse oximeter and $TcP0_2$ by the Litton oxymonitor) in terms of (1) preparation time, (2) response to changes in physiological conditions and, (3) continuity of monitoring in 26 patients . Results: (1) $TcS0_2$ monitor took an average time of 25.8±8.1 sec but $TcP0_2$ monitor required 10.3±2.3 minutes of preparation and calibration time. (2) Initial response time to physical disturbances (heel prick or ET suction) was slower in $TcP0_2$ compared with $TcS0_2$ (1.07±0.82 min vs 0.69±.50 min, p<0.01). Skin hypoperfusion encountered in shock made both techniques inoperative. (3) Only $TcP0_2$ monitoring required interruption (site change every 2 hours) to avoid skin burn. No interruption was needed in $TcS0_2$ monitoring. Total interruptions averaged 123 min per 24 hours per patient. Monitoring areas for $TcS0_2$ are restricted to hands, feet, fingers and toes. Movement of extremities disrupted $TcS0_2$ reading. This is not a problem for $TcP0_2$ monitoring. NICU nursing & medical staff uniformly preferred the pulse oximetry because of its advantages demonstrated in this study, specifically ease of application, absence of skin burns, quicker response times, and fewer interruptions of monitoring.

●214 PROSTAGLANDIN METABOLISM AND PULMONARY VASCULAR RESPONSE TO CHANGES IN PCO2 IN INFANTS. David L. Wessel, Paul R. Hickey, Dolly D. Hansen and Myron B. Peterson (Spon. by James E. Lock), Harvard Medical School, The Children's Hospital, Departments of Anesthesia and Cardiology and Tufts-New England Medical Center, Department of Pediatrics, Boston, MA.

We examined the effects of graded changes in arterial pH and PCO2 on pulmonary and systemic hemodynamics and on thromboxane and prostacyclin metabolism in 15 infants following repair of their congenital heart disease. Right and left atrial, pulmonary and radial artery catheters were placed intraoperatively with a pulmonary artery (PA) thermistor for measurement of thermodilution cardiac index (CI). When hemodynamically stable on 40% inspired oxygen, baseline measurements, including mean airway pressures, were obtained. Ventilation was adjusted to obtain measurements at 5 levels of PCO2; PA and left atrial plasma samples were obtained for thromboxane and prostacyclin assays.

Hyperventilation lowered pulmonary vascular resistance (PVRI) in 13/15 patients. Increases in pulmonary artery pressure (PAP) and PVRI occurred at elevated PCO2's in all patients (PAP>systemic in 2 patients). These changes occurred independently of thromboxane levels. Despite increases in mean airway pressure, moderate hyperventilation may decrease PVRI in the postoperative cardiac infant. Moderate hypercarbia raises PVRI and may be detrimental to ventricular performance.

PCO2 (mm Hg)	22±3	44±4*	54±5*	*p<.01 for
pH	7.65±.06	7.40±.04*	7.29±.03*	comparison to
PAP (mm Hg)	20±.05	24±7*	36±15*	preceding base-
PVRI(mmHg/L/m)	3.2±1.5	4.4±2.2*	7.8±5.4*	line measurement

▲215 OPTIMAL POSITIVE END-EXPIRATORY PRESSURE (PEEP) IN INFANTS AND CHILDREN WITH ACUTE RESPIRATORY FAILURE. Madolin K. Witte, Sharon M. Galli, Robert C. Chatburn and Jeffrey L. Blumer. Case Western Reserve University School of Medicine, Rainbow Babies and Childrens Hospital, Department of Pediatrics, Cleveland, Ohio.

PEEP has become the mainstay in the treatment of hypoxemic acute respiratory failure (ARF). While PEEP improves oxygenation by decreasing intrapulmonary shunting, it may also impair cardiac output and hence decrease oxygen delivery (O_2D) despite increased arterial oxygen content (CaO_2). Since optimizing O_2D is the goal of therapy in ARF, we sought to determine whether the level of PEEP which results in maximal O_2D can be estimated using noninvasive measurements of lung compliance (C). We studied 14 normovolemic children, aged 2 wks to 11 yrs, with ARF due to pneumonia or ARDS. Indicator dilution cardiac index (CI), arterial O_2 partial pressure (PaO_2), CaO_2, C, and O_2D were determined at 0, 3, 6, 9, 12 and 15 cm H_2O PEEP. Tidal volume and FiO_2 were held constant. The level of PEEP (m±SD) at which O_2D was maximal was 5.8±5.3 cm, and ranged from 0-15 cm in individual pts. PEEP of maximal C averaged 8.5±6 cm (range 0-15 cm) and was the same as PEEP of maximal O_2D in 6 pts (43%) but higher (7 pts) or lower (1 pt) than PEEP of maximal O_2D in the remainder; no consistent relationship between O_2D and C was observed. PEEP of maximal CI was identical to PEEP of maximal O_2D in all pts; higher levels of PEEP were associated with a significant decrease in CI, from 5.47±2 L/min/m^2 at PEEP of maximal O_2D to 4.39±2 L/min/m^2 at PEEP 9 cm above that of maximal O_2D. PEEP of maximal PaO_2 averaged 12.2±4 cm (range 0-15 cm), and corresponded to PEEP of lowest O_2D in 7 pts. At levels of PEEP above that of maximal O_2D, PaO_2 continued to increase significantly, from 115±40 torr at PEEP of maximal O_2D to 145±75 torr at PEEP 9 cm above that of maximal O_2D. We conclude that PEEP of maximal C does not reliably predict PEEP of best O_2D in children with ARF. Because PaO_2 continues to rise at levels of PEEP which cause significant decline in CI, maximizing PaO_2 will not optimize O_2D unless therapy to maintain CI is also employed.

216 CLINICAL EXPERIENCE WITH HIGH FREQUENCY JET VENTILATION (HFJV) IN PEDIATRIC PATIENTS. Madolin K. Witte, Ann M. Rudloff, Robert C. Chatburn. (Spon. J.L. Blumer) Case Western Reserve University School of Medicine, Rainbow Babies and Childrens Hospital, Department of Pediatrics, Cleveland, Ohio.

HFJV has been developed as an alternate mode of mechanical ventilation which employs very small tidal volumes at rapid rates. Its theoretical advantages over conventional ventilation (CV) include less barotrauma and less cardiovascular depression due to lower airway pressures. While HFJV has been used successfully for treating respiratory disorders in adults and neonates, experience with this mode of ventilation in older children is limited. We have reviewed our experience with 22 pts, aged 2 wks to 20 yrs (m±SD 5.1±6.7 yrs) who received HFJV for treatment of respiratory failure (RF) not adequately controlled with CV. The primary diagnosis was pneumonia in 13 pts, ARDS in 7 pts, and cardiogenic shock in 2 pts. Indications for switching from CV to HFJV were high peak inspiratory pressure (PIP) in 14 pts (64%), refractory hypercarbia in 5 pts (23%) and refractory hypoxemia in 3 pts (13%). Nine pts (41%) had one or more pneumothoraces (PN) during CV. HFJV was initiated with driving pressures of 6-43 psi (m±SD 18.6±9.8 psi) and rates of 95-233 breaths/min (m±SD 145±34). PIP decreased from 61±17 cm H_2O during CV to 46±15 cm H_2O during HFJV and ΔP (PIP-PEEP) decreased from 49±15 cm H_2O to 32±15 cm H_2O (both p<0.001). Mean PEEP increased slightly, from 11.6±5 cm H_2O to 13.5±7 cm H_2O (NS). Partial pressure of CO_2 was lower during HFJV (40±13 vs 46±10 mmHg, p < 0.05); oxygenation, as measured by arterial:alveolar pO_2, did not change. In 4 pts, HFJV was discontinued within 6 hrs due to worsening arterial blood gases. Of the remaining pts, nine were successfully weaned from HFJV and survived, and 9 expired while receiving HFJV. Duration of HFJV ranged from 2 hrs-20 days (m±SD 6.2±5.7 days), and was shorter in survivors (m±SD 5.7±3 days) than in nonsurvivors (m±SD 9.4±7 days). PN developed in 12 pts (54%) during HFJV; no other complications were noted. HFJV may successfully treat some cases of RF refractory to CV.

DEVELOPMENTAL BIOLOGY

217 THE SYMMETRIC TONIC NECK REFLEX (STNR) AS A NORMAL FINDING IN PREMATURE INFANTS PRIOR TO TERM. Marilee C. Allen (Spon. by M. Douglas Jones, Jr). The Johns Hopkins Hospital and Kennedy Institute, Dept. of Pediatrics, Baltimore, MD 21205

The STNR is a primitive reflex that is characterized by upper extremity (UE) extension and lower extremity (LE) flexion with neck extension, and by UE flexion and LE extension with neck flexion. Although often seen in children with cerebral palsy (CP), it is an uncommon finding in term neonates and infants. Its frequency has been studied in a population of 110 premature infants who were examined at and/or prior to term and who had normal motor milestones on followup at a mean age of 27 months (12-61). The STNR was graded as to intensity and completeness, in the manner of Capute et al (DMCN 26:375, 1984). Mean BW was 1141 gms (460-2190); mean GA was 28.6 wks (23-35). Forty-six had multiple exams prior to term.

At term (or NICU discharge), 42% had a definite (Grade 2) STNR and 9% had a complete (Grade 3) STNR. Only 1% had Grade 1 STNR (tone changes only). Of the 53 (48%) who were scored as no STNR, 6 (11%) had evidence of STNR in either the UE or LE (partial STNR). Of the 46 who had multiple exams, 28% had an STNR on one exam but not on an earlier or later exam. When the data on all 238 exams were analyzed by postconceptional age (PCA), the STNR was not elicited prior to 28 wks PCA and was present in 4-6% at 29-32 wks PCA. The frequency and strength of the STNR progressively increased with PCA. By term, 32% had Grade 2 and 14% had Grade 3 STNR.

The STNR is a normal finding in premature infants prior to term. It emerges at 30 wks PCA, and is present in half of premature infants at term.