1225 SKIN SENSORS FOR MONITORING OXYGEN TENSION OF NEWBORNS. Wolfgang F.H. Mindt and Patrick Eberhard (sponsored by Avron Y. Sweet). F. Hoffmann-La Roche & Co., A.G., Dept. of Bio-Electronics, Basle, Switzerland.

The measurement of oxygen tension (PO_2) can be obtained indirectly by applying to the skin a Clark-type electrode sensor heated to a constant temperature higher than the skin. We have designed a clinically useful sensor which consists of a concentrically arranged anode, heating element and a 4 mm diameter gold cathode. The size of the cathode permits the measurement of the average PO_2 from a large surface area of skin. Sensor oxygen consumption is minimized by the use of a Mylar(R) membrane which has a low permeability for oxygen. The calibration curve of the sensor in the gas phase is linear between 0 and 100% O_2 and the response time (T90%) of 40 sec. is adequate for clinical use. The correlation between arterial and cutaneously measured PO_2 is excellent when the sensor temperature is maintained at 44°C (r= 0.934). We have found that cutaneous PO_2 measurement is of particular value when evaluating the immediate effects of therapy. These include changes in ventilation, shock therapy, endotracheal suction and the effects of routine care. Cutaneous PO_2 is an indirect determinant of PaO_2 and depends upon adequate peripheral circulation. Therefore, the cutaneous PO_2 may not be reliable when there is marked vasoconstriction.

1226 HIGH INCIDENCE OF LUNG PERFORATION BY CHEST TUBE IN NEONATAL PNEUMOTHORAX. Moessinger,A.C., Driscoll,J.M.,Jr. and Wigger H.J.,(Spon. by Blanc, W.A.), Depts. of Peds. & Path., Columbia Univ., Coll. of P&S, N.Y.

We found iatrogenic lung perforation by chest tube to be a frequent complication of percutaneous pleural drainage in the newborn with severe tension pneumothorax. Of 209 consecutive patients admitted to the Neonatal ICU with clinical RDS, 28 (13.4%) developed severe tension pneumothorax requiring pleural drainage and 21 of these expired. Twenty were autopsied. A perforation of the lung directly related to the pleural drainage was found in 7 of 20 (35%); none of these had been diagnosed clinically. The chest tubes were inserted by standard technique, using #10-12 Argyle tubes (preceded by #18-22 Medicut aspiration in half of the cases.) There was anatomic and microscopic evidence of pre-mortem lung perforation by chest tubes in 5/7 and by catheters in 2/7. In the absence of pleural adhesions, the increased stiffness of these lungs most likely predisposed them to perforation.

Although our incidence of pneumothorax requiring pleural drainage in patient with RDS has decreased from 21.5% to 11.7% between 1972 and 1975, the incidence of lung perforation in relation to chest tube insertion has not changed; it remains at 1 lesion per 10 tubes. The high incidence of this complication in our autopsy series suggests a need to reevaluate the technique of pleural drainage in the newborn with acute tension pneumothorax.

1227 INCREASED COMPLIANCE FOLLOWING PDA LIGATION IN HYALINE MEMBRANE DISEASE. Cheryl M. Naulty, Joan Conry, Paul Hamosh, and Gordon B. Avery. Children's Hosp. National Medical Center, George Washington University School of Medicine, and Georgetown University School of Medicine, Wash., D.C.

PDA ligation has been suggested in patients with HMD and large left to right shunts to improve lung function even in the absence of heart failure. The presumption is that lung mechanics will benefit, even though measurements have not been made to test this hypothesis.

In 8 infants with severe HMD, varying in age between 3 and 29 days, pulmonary function studies were performed the day before and after PDA ligation. A significant increase occurred in lung compliance ($P=<.05$), averaging 42%. Six of the 8 showed an increase, one was unchanged, and one showed a slight decrease. Mean compliance prior to ligation was 0.55ml/cm H_2O/Kg, a value indicating severe lung disease in our experience, and rose to 0.78. The 3 cases ligated in the first week of life showed relatively larger increases in compliance. Small numbers did not permit correlation of PDA ligation with survival. However, respiratory compliance work, the majority of pulmonary work in these babies, was reduced by an average of 42%. The lesser effect of late ligation may be the result of already established bronchopulmonary dysplasia.

1228 THE EFFECT OF VARYING THE INSPIRATORY FLOW RATE ON THE VENTILATION OF INFANTS WITH RESPIRATORY DISTRESS SYNDROME (RDS). Donald M. Null, Jr., Michael D. Stanley, and Robert A. deLemos (Spon. by Michael J. Sweeney). Wilford Hall USAF Medical Center, Dept of Pediatrics, San Antonio, TX.

The effect of random changes in inspiratory flow rate was evaluated in 15 infants with RDS on assisted ventilation with a time-cycled continual flow ventilator. Other ventilator parameters were not altered. Ten infants were on intermittent mandatory ventilation (IMV); five were controlled under curare paralysis. At a flow of 12 liters/minute delivered tidal volumes and peak tracheal pressures were higher in all but one infant and respiratory rates were increased in those breathing spontaneously. In spite of this, P_aCO_2 was elevated and V_A decreased in 12 of 15 patients.

	Flow Rate	V_T	RR	P_aCO_2	P_aO_2
IMV	6 L/min	25.3	27.6	41.4	71.2
	12	27.0	34.3	50.1	66.4
Curare	6	23.4	26	45.2	75.4
	12	26.0	26	60.3	67.2

No changes in cardiac output or right to left shunting were observed. The increase in V_D at the higher inspiratory flow rate may be related to increased volume of the anatomic dead space due to over-distention of the proximal airway.

1229 EARLY DETECTION OF HIGH MORTALITY RISK IN NEWBORN RESPIRATORY FAILURE. Melody J. O'Connor, Robert H. Bartlett, Nancy Wetmore, Ragnar Amlie, Robert F. Huxtable. (Spon. by Thomas L. Nelson) University of California, Irvine, Departments of Surgery and Pediatrics, Irvine, California

Objective measurement of newborn respiratory failure (NRF) is needed to compare treatment methods, compare groups of patients, and define indications for innovative treatment measures such as extracorporeal membrane oxygenation (ECMO). A neonatal pulmonary insufficiency index (NPII) has been developed which integrates hypoxemia, acidosis, and time into a single cumulative number which can be calculated retrospectively or prospectively. NPII analysis was carried out on 245 patients in the following groups: 81 respiratory distress syndrome (RDS) under 1500 gram, 110 RDS over 1500 gram, 47 meconium aspiration syndrome (MAS), and 7 persistent fetal circulation syndrome (PFC) with or without congenital diaphragmatic hernia.

NPII was calculated at 4 hour intervals in each group and compared to ultimate outcome. The percent survival and mortality was determined for the patients at risk for each level of NPII at each time interval. By defining NPII/mortality isobars for 50, 75, 100%, etc. mortality risk can be determined for an individual patient prospectively. Using this method, 13 infants with 100% mortality risk NRF were treated with ECMO within the first two days of life; six survived (46%).

1230 ASSOCIATION OF CHILDHOOD OBESITY-HYPOVENTILATION SYNDROME AND FAMILIAL DECREASED VENTILATORY RESPONSE TO HYPERCAPNIA. David M. Orenstein, Thomas F. Boat, Frank P. Primiano, Jr., Ruth P. Owens, Marvin D. Lough, and Carl F. Doershuk. Case Western Reserve University and Rainbow Babies and Childrens Hospital, Department of Pediatrics, Cleveland.

Subnormal ventilatory response to hypercapnia is accepted as part of the obesity-hypoventilation syndrome in adults, but ventilatory control has not been studied in children with the obesity-hypoventilation syndrome. We studied ventilatory response to hypercapnia in the families of 2 obese 13-year-old girls with the Prader-Willi Syndrome, one of whom had recovered from the obesity hypoventilation syndrome, and one of whom had never hypoventilated. Siblings and parents were not obese.

The response to hypercapnia, measured as the slope (S) of ventilation (L/min) vs. alveolar carbon dioxide tension (mmHg) during rebreathing, was decreased in the patient with the obesity-hypoventilation syndrome (S=1.0) and in 3 family members (mean S=1.1, range .7-1.4). The other Prader-Willi patient (S=3.6) and her family (mean S=2.2, range 1.6-3.6) had considerably greater responses. Young adult controls (mean S=3.3, range 2.8-4.2) fell within published normal ranges (S=1.5 - 5.0).

Respiratory failure in the child with the obesity-hypoventilation syndrome is probably related to two independent factors: obesity and a familial diminished response to hypercapnia. The familial factor may explain why only a small percentage of obese patients develop the obesity-hypoventilation syndrome.