**1189** CHEST PHYSIOTHERAPY IN THE NEONATE WITH RESPIRATORY DISTRESS. Neil N. Finer, Michael G. Grace & Jan Boyd (Spons. by D. Schiff) University of Alberta, Royal Alexandra Hospital, Dept. of Pediatrics, Edmonton, Alberta

Chest physiotherapy is a frequently practiced but poorly documented form of therapy. Twenty neonates (mean age=43 hr) were studied with a variety of respiratory disorders to assess the effect of complete chest physiotherapy on arterial blood gases. This was compared to the alteration of blood gases following suctioning of the airway. Nine were receiving added oxygen alone, six were receiving continuous distending pressure and five were intubated receiving mechanical ventilation. Complete chest physiotherapy treatment consisted of postural drainage with percussions and vibrations in each drainage position followed by suctioning of the airway. The treatment was performed for a specific area of lung involvement if present. For generalized lung disorders, drainage was performed with an emphasis on the basal segments of the lower lobes. Each infant had arterial blood gases performed five minutes prior to and twenty minutes following suctioning, and similarly before and after physiotherapy (average interval between the two pairs=1.8 hr) There was a mean increase of 20.8 mm Hg in the $pO_2$ following physiotherapy, ($p<0.01$) with no significant change observed following suctioning. There was no significant change in the pH or $pCO_2$ with either procedure. Analysis of covariance revealed no significant correlations between $pO_2$ and sex, age, body weight, gestation, inspired oxygen concentration, or the order of receiving the procedures. In neonates with respiratory distress, oxygenation is improved following physiotherapy.

**1190** PULMONARY IRRITANT REFLEXES IN NEWBORN INFANTS. F. Fleming, H. Bryan, A.C. Bryan: Research Institute The Hospital for Sick Children, Toronto, Canada.

**It has been well established that slowly adapting vagal stretch receptors (the Hering-Breuer reflex) are active in newborn infants, while the vagal rapidly adapting (irritant) receptors have not been studied. We have tested the activity of the irritant receptors in two ways by 1. rapid lung deflation with negative pressure (- 5 cm) applied via a face mask; and 2. direct stimulation of the bronchial mucosa with a fine catheter in intubated infants. Rapid lung deflation in 8 infants (gestation 29-40 weeks) failed to stimulate respiration in all (control frequency 46±16; frequency during deflation 43±16, mean±SD). Direct bronchial mucosal stimulation in 8 intubated babies (gestation 29-39 weeks) failed to stimulate respiration in 5 infants less than 35 weeks gestation. In 3 infants, 35-39 weeks, respiratory frequency markedly increased or the infant coughed.**

**The failure to elicit a deflation reflex in all infants, and the absence of response to mucosal stimulation in some infants suggests that vagal irritant reflexes are weak or absent in human newborns. This may be one reason why aspiration is common in this age group.**

**1191** A NEW APPROACH FOR MEASURING FUNCTIONAL RESIDUAL CAPACITY (FRC) IN THE INTUBATED INFANT. William W. Fox, Jacob G. Schwartz, Thomas H. Shaffer (Spon. by Jean A. Cortner) Univ. of Pa. Sch. of Med., Depts. of Peds. and Physiol. and The Children's Hospital of Philadelphia, Philadelphia, PA.

Measurement of FRC in distressed neonates on continuous positive airway pressure (CPAP) with endotracheal (ET) tubes presents special problems. Since neonatal ET tubes are uncuffed they permit leakage of gas around the tube during respiration and, therefore, introduce errors in FRC determination. The present study evaluates a new 60 second closed circuit helium (He) dilution technique for determination of FRC independent of small gas leaks. By analytically relating the fall in He concentration due to mixing with that due to leakage it is possible to predict the final equilibration concentration of He and, therefore, correct for ET tube leaks. The system (120 ml) contains an air pump, He meter, breathing bag in cylinder, a strip chart readout, and solenoid valve. CPAP or ventilator pressure can be applied during testing. Fifty in vitro measurements of FRC ranging from 5-50 cc in both leak and non-leak models were accurate to 7.2 and 5.2% respectively. Seventy-two FRC measurements were performed on 15 neonates (700-4400 g) on CPAP with ET tubes. Leak rates were significantly higher ($P<.001$) on 3 cm $H_2O$ CPAP compared to 0 cm $H_2O$ CPAP resulting in a mean (±SEM) total helium loss in 60 seconds of 16.2 (± 1.1)% and 9.1 (± 0.5)% respectively. The mean measured FRC was 53.5 ml at 3 cm $H_2O$ CPAP and 46.3 at 0 cm $H_2O$ CPAP. If leak calculations were not considered the error in FRC could have been as high as 76.7 and 42.7%. This method permits accurate calculation of FRC in neonates on CPAP with ET tubes.

**1192** ALTERATIONS IN NEONATAL RESPIRATORY FUNCTION FOLLOWING CHEST PHYSIOTHERAPY. William W. Fox, Jacob G. Schwartz, Thomas H. Shaffer (Spon. by Jean A. Cortner) Univ. of Pa. Sch. of Med., Depts. of Peds. and Physiol. and The Children's Hosp. of Phila., Philadelphia, PA.

Percussion, suctioning and hyperventilation have been recommended for airway management in neonates requiring endotracheal tubes. To investigate physiological alterations in respiratory function due to chest physiotherapy, we measured arterial blood gases, respiratory patterns, lung mechanics, and functional residual capacity (FRC) in 10 neonates, weights (1.25 to 3.20 kg) during the control period, post vibration of the chest and suctioning, after hyperventilation, and 2 hours post suctioning. Post suctioning compared to controls mean (± SEM) $PaO_2$ decreased 75.2 (± 9.3) to 44.0 (± 3.1) mm Hg ($P<0.01$) while lung compliance and FRC were unchanged. There was a decrease in inspiratory resistance (RI) from 81.8 (± 14.6) to 59.0 (± 10.6) cm $H_2O$/L/sec. ($P<0.02$) and I:E ratio increased from 0.93 (± 0.04) to 1.04 (± 0.06) ($P<0.07$). Hyperventilation compared to post suctioning resulted in an increase in mean (± SEM) $PaO_2$ to 63.9 (± 10.0) mmHg ($P<0.01$), and RI to 98.3 (± 22.0) cm $H_2O$/L/sec. ($P<0.05$). FRC, CL, VT were unchanged. Two hour followup values for all parameters studied were similar to control values except for a trend toward increased compliance. There were no significant differences at any stage of the study for $PaCO_2$, pH, base excess, VT, or minute ventilation. This study indicates that there is a significant decrease in $PaO_2$ after chest vibration and suctioning increase in $PaO_2$ after hyperventilation but these changes do not appear to be related to alterations in lung volume.

**1193** FACTORS AFFECTING LUNG VOLUME IN POST EXTUBATED NEONATES. William W. Fox, Jacob G. Schwartz, Thomas H. Shaffer (Spon. by Jean A. Cortner) Univ. of Pa. Sch. of Med., Depts. of Peds. and Physiol., and The Children's Hospital of Phila., Philadelphia, PA.

Extubated neonates previously treated with endotracheal continuous positive airway pressure (CPAP) maintain arterial oxygen tension ($PaO_2$) and functional residual capacity (FRC) equivalent to values at 2-3 cm CPAP without alteration in inspired oxygen concentration. To determine the factors that maintain $PaO_2$ and FRC after extubation we studied arterial blood gases, lung mechanics, and FRC in 15 neonates weighing 1.4 to 4.4 kg. Intraesophageal pressure, air flow, and tidal volume provided for calculation of lung compliance (CL), and lung inspiratory (RI) and expiratory (RE) resistance. Following extubation at zero CPAP, increases occurred in mean (± SEM) $PaO_2$ from 59.3 (± 5.8) to 79.5 (± 4.0) mm Hg ($P<0.05$); FRC from 53.9 (± 6.0) to 67.3 (± 10.0) ml; RE from 148.0 (± 17.3) to 167.5 (± 25.7) cm $H_2O$/L/second, and CL from 1.70 (± 0.33) to 2.09 (± 0.4) ml/cm $H_2O$. I:E ratio decreased from 0.95 (± 0.05) at zero CPAP to 0.83 (± 0.07) after extubation ($P<0.05$). A significant correlation existed between FRC and expiratory resistance for all patients ($P<0.01$). No significant alterations occurred in $PaCO_2$, base excess, minute ventilation, tidal volume, respiratory rate and heart rate. The changes in FRC with changes in expiratory resistance after extubation indicate that upper airway resistance , possibly at the laryngeal level may have a major role in maintenance of an adequate FRC after extubation.

**1194** OXYGEN TOXICITY: COMPARISON OF LUNG BIOCHEMICAL RESPONSES OF NEONATAL AND ADULT RATS. Lee Frank, John Yam, and Robert J. Roberts, The University of Iowa, Depts. of Pediatrics and Pharmacology, Iowa City, Iowa.

Although immature animals have long been known to be less susceptible to $O_2$ toxicity than adults, the basic mechanism(s) to explain this phenomenon remains unresolved. Two biochemical mechanisms for protection of the lung from $O_2$-induced injury have been proposed: the glutathione (GSH) system in reducing toxic lipid peroxides and the superoxide dismutase (SOD) system in eliminating superoxide anion. Experiments were carried out to determine whether these lung defense systems respond differently in neonatal and adult rats exposed to toxic concentrations of $O_2$. Neonatal rats (4 to 7 days old) and adult rats (250-300 g) were continuouly exposed to either 96-98% $O_2$ or room air in monitored exposure chambers. All the $O_2$-exposed adult rats showed extensive pulmonary edema and 65% died within 3 days of $O_2$ exposure. Neonatal rats, however, all survived up to 5 days of $O_2$ exposure without gross evidence of lung edema. During the course of exposure animals were sacrificed for biochemical analysis and the data expressed on a per lung basis as % of control values. After 72 hours of $O_2$ exposure neonatal rats showed increased activity of GSH (171%), GSH-peroxidase (GP) (126%), GSH-reductase (GR) (120%), glucose-6-phosphate dehydrogenase (G-6-PD) (139%), and SOD (114%). Adult rats, however, failed to show increases in pulmonary GSH, GP, GR, and SOD activity. Thus, the resistance of the neonatal lung to $O_2$-induced injury may be due to the augmented activity of these protective enzyme systems. (Supported by GM 12675 and NIH 1F32 HL05415.)