

**1694** GASTROESOPHAGEAL REFLUX (GER) AND ITS RELATIONSHIP TO NOCTURNAL ASTHMA. Michael E. Martin, Michael M. Grunstein, Gary L. Larsen. (Spon. by Richard B. Johnston, Jr.) Nat. Jewish Hosp. and Res. Ctr. and U. Colo. Sch. Med., Dept. of Pediatrics, Denver.

GER occurs in a high percentage of asthmatic children. To determine if GER can lead to nocturnal asthma (NA), 25 pediatric inpatients (age 2-14 yrs) were selected for study based on a history of NA. Evaluation included 3 to 13 weeks ( $\bar{x}=54$  days) of observation to quantitate day and night wheezing frequency. Two groups of patients were identified: 17 patients with predominant day-time asthma (DA) and 8 patients with prominent NA. All were studied with over-night esophageal pH recordings to detect GER during sleep while also monitoring transcutaneous oxygen ( $TcO_2$ ) and clinical status. Reflux scores (RS) were determined (Surgery 84:16, 1978). Sixteen of 25 (64%) patients had abnormal GER including all 8 patients with NA. Overall, a significant positive correlation between RS and percentage of nights with wheezing was found ( $r=.52, p=.005$ ) while age, serum theophylline levels, and lung function ( $FEV_1, FEF_{25-75}$ ) at the time of study did not correlate with GER. Comparing NA and DA groups, the NA patients had significantly higher RS ( $p<.001$ ) but there were no differences in age, theophylline levels, or lung function. Three of the 8 NA patients had a decreased  $TcO_2$  and/or clinical wheezing during an episode of GER. This study shows a significant association between NA and GER that cannot be explained by age, lung function, or theophylline levels. A cause-effect relationship was suggested in 3/8 patients with NA. We speculate that GER is one of several mechanisms that may produce NA in patients with reactive airways.

**1695** VULNERABILITY OF PRETERM INFANTS TO NASAL OBSTRUCTION R.J.Martin, F.G.A.Versteegh, W.A.Carlo, J.V.Anderson, and E.N.Bruce. Dept. of Ped., CWRU, Cleveland, Ohio

This study was designed to determine cardiopulmonary responses to nasal obstruction in different sleep states. 8 healthy preterm infants (wt 1.8±.1Kg) were studied at a corrected G.A. of 35±2 wks by multiple 10 sec occlusions during active (AS) and quiet (QS) sleep, via nasal prongs fitted with a thermistor to measure airflow. Heart rate (HR), mouth airflow, transcutaneous  $PO_2$  ( $TcPO_2$ ), chest wall movements, respiratory frequency (f) and sleep state were continuously monitored. Nasal occlusion was invariably accompanied by a fall in  $TcPO_2$ , which was greater during AS than QS ( $8\pm 2$  vs  $5\pm 3$  mmHg,  $p<.01$ ). In contrast, HR fell with only 54% of occlusions, more in AS than QS ( $35\pm 15$  vs  $21\pm 7$ /min,  $p<.05$ ). During obstruction the frequency of respiratory efforts decreased from  $45\pm 10$  to  $35\pm 7$ /min ( $p<.001$ ) compared to preocclusion levels, while mouth airflow was only sporadic and did not influence the fall in  $TcPO_2$  or HR. In the initial 5 sec following occlusion, f returned to preocclusion levels. During the subsequent 5 sec, f decreased from  $47\pm 10$  to  $35\pm 13$ /min ( $p<.03$ ) in AS and from  $41\pm 9$  to  $31\pm 16$ /min ( $p<.03$ ) in QS, as compared to preocclusion levels. Furthermore, in the 20 sec following occlusion (vs preocclusion) the duration of respiratory pauses  $\geq 2$  sec increased in both AS and QS ( $p<.01$ ). We conclude that 1) preterm infants are more vulnerable to nasal obstruction in AS with a greater fall in  $PO_2$  and HR, 2) airway obstruction may enhance susceptibility to the subsequent development of central apnea, and 3) since obstruction may not be accompanied by a fall in HR, routine cardio-respiratory monitoring may fail to detect many episodes.

**1696** EFFECTS OF UPPER AIRWAY (UA) INTRALUMINAL PRESSURE ON RESPIRATORY FREQUENCY. Commen P. Mathew, Yousef K. Abu-Osba and Bradley T. Thach. Wash. Univ. Med. Sch., St. Louis Children's Hosp., Dept. Ped., St. Louis, MO.

Reduced respiratory frequency (f) is seen during obstructive and mixed apnea. Since intrathoracic pressure changes in obstructive and mixed apnea are conducted to the larynx and pharynx, we wondered if UA pressure changes could contribute to the reduced f, in addition to lung and chemoreceptor reflexes. Therefore, we studied the effects of UA pressure changes on f by raising or lowering the pressure in the isolated UA (nose, pharynx and larynx) during tracheostomy breathing and by adding respiratory loads (airway occlusion) after eliminating lung stretch reflexes by cervical vagotomy. Comparison of the first occluded with the preceding breath eliminated chemoreceptor influences. The integrated diaphragmatic EMG was used to determine f. The effect of a sustained pressure change in the isolated UA was tested in 15 anesthetized (Pentothol) rabbits. A rapid decrease in f during negative pressure change (up to 35%) and an increase in f during positive pressure change (up to 20%) were seen. The percentage change in f correlated with the magnitude of pressure change ( $2-10$ cm  $H_2O$ ). The nasal or tracheostomy airway was occluded briefly (at FRC) in 6 vagotomized animals. During nasal occlusion inspiratory and respiratory cycle duration was prolonged (10-20%) whereas no change was seen during tracheostomy occlusion. We conclude that response to UA pressure changes may contribute to the reduced respiratory frequency seen during mixed and obstructive apnea. (Funding: NIH grant#HD10993)

**1697** ROLE OF ENDOGENOUS OPIATES IN  $CO_2$  SENSITIVITY IN THE NEWBORN PRIMATE. Dennis E. Mayock, Robert D. Guthrie, David E. Woodrum, University of Washington, Department of Pediatrics, Seattle, WA.

Recent reports indicate that naloxone will shorten the duration of primary apnea following asphyxia (Ped.Res. 14:357, 1980) and prevent the secondary depression of ventilation during hypoxia in the newborn rabbit (Ped.Res.14:643, 1980). Previous authors have shown the  $CO_2$  sensitivity in the newborn increases with postnatal maturation (J.A.P. 41:41, 1976; J.A.P. 48:347, 1980). To determine whether endorphins depress  $CO_2$  sensitivity in the immediate newborn period, five newborn  $M. nemestrina$  were studied on day 2-3 and again on day 19-21.  $V_T$ /Kg and  $PO_2$  were measured in duplicate trials in tracheotomized animals during steady state hyperoxia ( $FiO_2=1.0$ ), then again at 5-7 minutes of hyperoxic hypercapnia ( $FiO_2=0.96, FICO_2=0.04$ ). Naltrexone was given IV at a dose of 0.1 mg/kg and the trials were repeated.

	PreDrug	PostDrug	PreDrug	PostDrug
Day	308.98	NS	98.89	4.32
2-3	+187.03	+15.91	+1.91	+0.66
Day	116.49	NS	129.19	2.33
19-21	+35.75	+59.98	+0.38	+1.31

Values are mean  $\pm$  S.E.M. Statistical analysis by paired t test. These results suggest that endogenous opiates do not influence the hyperoxic hypercapnic response in the newborn subhuman primate and confirm recent reports in adult humans (Am.Rev.Resp. Dis.121:1045,1980). (Grants HD 10356 & MCT-000955)

**1698** ABNORMAL HYPERCARBIC AND HYPOXIC AROUSAL RESPONSES IN NEAR-MISS (N-M) SIDS. Kristine McCulloch, Robert T. Brouillette, Anthony J. Guzzetta and Carl E. Hunt.

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Whereas a normal infant should arouse from sleep and resume breathing in response to the hypoxic ( $\downarrow O_2$ ) and hypercarbic ( $\uparrow CO_2$ ) stimuli associated with sleep apnea, N-M SIDS infants are less likely to arouse in response to  $\downarrow O_2$  or  $\uparrow CO_2$  stimuli (Hunt, ARRD 121:290, 1980).  $\uparrow CO_2$  and  $\downarrow O_2$  arousal responses (AR) were measured in 22 normal and 11 N-M SIDS infants at 7.3  $\pm$  3.3 (SD) and 9.3  $\pm$  4.4 weeks of age, respectively (NS). AR were performed during natural sleep by altering inspired gas concentration ( $FICO_2, FIO_2$ ) in a headhood; end-tidal  $CO_2$  ( $PACO_2$ ),  $tcpO_2$ , ECG and heart rate, thoracic and abdominal circumference (strain gauges) were continuously recorded. For each  $\uparrow CO_2$  AR, step increases in  $FICO_2$  were made at 5-minute intervals until arousal occurred. For each  $\downarrow O_2$  AR, step decreases in  $FIO_2$  were made at 3-minute intervals until arousal occurred or until  $FIO_2=0.15$ . Behavioral criteria for arousal were agitation and eye opening and/or crying. AR to  $\uparrow PACO_2$  occurred at a significantly higher mean  $PACO_2$  in N-M SIDS than control infants, 55  $\pm$  3 (SD) versus 49  $\pm$  6, respectively ( $p<.05$ ). AR to  $\downarrow O_2$  occurred in 70% of normal versus only 9% of N-M SIDS infants ( $p<.01$ ). In the one N-M SIDS infant in whom an  $\downarrow O_2$  AR occurred,  $\uparrow CO_2$  AR did not occur until  $PACO_2=61$  mmHg. In summary, the level of respiratory chemostimulation required to produce an AR from sleep is significantly greater in N-M SIDS than in normal infants. Deficient AR may prevent N-M SIDS infants from responding appropriately to apneic asphyxia.

**1699** TRACHEAL BRONCHUS: ASSOCIATION WITH RESPIRATORY MORBIDITY IN CHILDHOOD. F.J. McLaughlin, G.B.C. Harris, D.J. Strieder and A. Eraklis, Children's Hospital Medical Center and Harvard Medical School, Boston, MA 02115.

A bronchus arising from the trachea in man is an error of airway development, seen in 1-3% of adult bronchographies. At this hospital 18 cases involving the right upper lobe (RUL) were seen in 1964-79, with a frequency of 2% at bronchoscopy. One patient had a RUL mass: a tracheal bronchus leading to a sequestration was diagnosed at surgery. The other 17 were diagnosed at bronchoscopy, with bronchography in 11 cases. Ages ranged from 1 day to 54 mo (mean 17 mo). The children had respiratory complaints such as recurrent pneumonia (9 patients) or stridor (6). Eight had an ectopic RUL bronchus ("pig bronchus"), 2 an ectopic apical segmental bronchus and 5 a supernumerary bronchus (one of which was the sequestration). In 3 patients anatomic type was not defined. Ten patients had another congenital abnormality. Five of the 9 patients with recurrent pneumonia, who had either an ectopic apical or a supernumerary bronchus, underwent resection of the RUL (4) or the apical segment (1). Indication was a history of RUL disease and in 4/5 bronchographic evidence of bronchiectasis or bronchial stenosis. Through a 5 year follow up period these patients have remained well. Of the 4 unoperated patients, 2 have had additional admissions for pneumonia, involving lobes other than the RUL and therefore doubtfully related to the bronchial anomaly. In conclusion, anatomic types other than ectopic RUL bronchus were often associated with respiratory morbidity, requiring surgery in 6 out of our 10 cases.