

**252** ARTERIAL CHEMOREFLEX REGULATION OF FETAL HEART RATE (FHR) AND BLOOD PRESSURE. Joseph Itskovitz, Abraham Rudolph. Univ. Calif., C.V.R.I., San Francisco.

Acute studies of the role of aortic (AC) and carotid (CC) chemoreceptors in fetal circulatory regulation have been inconclusive. We measured heart rate (HR) and aortic pressure in 26 chronically instrumented fetal lambs (116-130 days) 2 to 5 days after surgery. Fourteen fetuses served as control, 7 had aortic and carotid (sinoaortic) denervation (SAD), and 5 had only carotid denervation. Acute hypoxia was produced for 20 sec by decreasing uterine blood flow by inflating a balloon in the maternal aorta. In the controls, hypoxia caused a 27% fall of HR (172±14 vs. 125±28 bpm, p<0.001) and an increase in aortic pressure (42.6±2.8 vs. 46.5±3.6 torr, p<0.001) that followed the bradycardia. SAD abolished the bradycardia and the hypertension after uterine blood flow reduction. We also injected cyanide (CN) into the fetal inferior vena cava (25-150 µg/kg, n=10) to stimulate the chemoreceptors. CN produced a 35% fall in HR and variable BP changes. CN did not affect HR or aortic pressure in the SAD fetuses, but with carotid denervation alone, bradycardia and hypertension still occurred. Thus, aortic and carotid chemoreceptors are active in utero and are responsible for the HR and blood pressure changes during acute fetal hypoxia.

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**252A** EFFECTS OF HEMORRHAGE (H) ON DISTRIBUTION OF UMBILICAL VENOUS RETURN (UVR) AND O<sub>2</sub> DELIVERY IN FETAL LAMBS. Joseph Itskovitz, Boyd Goetzman, Abraham M. Rudolph. Univ. Calif., Cardiovasc. Res. Institute, San Francisco.

We have shown that umbilical venous (UV) blood and O<sub>2</sub> delivered through the ductus venosus (DV) is preferentially distributed to the heart and brain. This phenomenon is enhanced during hypoxia while umbilical venous return (UVR) is maintained. We have now examined the effects of reducing UVR by hemorrhage (22.6±1.9% of fetal blood volume) in 8 chronically catheterized fetal lambs (122-128 d gestation). UVR and its distribution was measured by the microsphere method and O<sub>2</sub> delivery was calculated from DV derived blood flow and UV O<sub>2</sub> content. The following data were obtained:

	QUV	UVO <sub>2</sub> Cont.	O <sub>2</sub> Delivery	Q DV	
	ml/min/kg	ml/dl	ml/min/kg	ml/min/kg	%UVR
CONT	249	11.0	26.8	138	58.1
	±17	±0.6	±0.8	±19	±6.0
H	184*	10.2†	18.6*	124	67.4†
	±14	±0.5	±1.2	±12	±6.7

\*p 0.001, †p 0.05, values are x + SE

In addition, UV derived blood flow and O<sub>2</sub> delivery to the brain, heart, placenta, and kidneys were maintained despite the observed changes in UVR and O<sub>2</sub> delivery, but that to the liver, carcass, lungs, and gut decreased following H. We conclude that fetal adjustment to H is accomplished by increasing the amount of UVR and O<sub>2</sub> that bypassed the liver through the DV. The DV blood flow is further redistributed to maintain UV derived blood flow and O<sub>2</sub> delivery to vital organs at the expense of other organs.

**253** RESPONSE TO RAPID VOLUME EXPANSION DURING THE POST-NATAL PERIOD. Stanley James, Salha Daniel, and José Strauss. Depts. of Pediatrics and Anesthesia, College of Physicians and Surgeons, Columbia Univ., New York, N.Y.; Dept. of Pediatrics, Univ. of Miami Sch. of Med., Miami, Florida.

This study was designed to test the hypothesis that the post-natal diuresis observed in healthy neonates during the second hour of life is due to an expansion of their extracellular volume (ECV) as a result of manual or spontaneous placental blood transfusion (Strauss, J., Daniel, S., and James, L.S., Pediatrics, In Press). Seven healthy infants were infused with isotonic glucose during the third or fourth hour of life. Plasma and urine were analyzed for osmolality, inulin and para-amino hippuric acid in order to estimate osmolal and free water clearances as well as glomerular filtration rate (GFR) and renal plasma flow (RPF). Despite individual variation in initial values and in response, glucose infusion caused a prompt diuresis which was accompanied by an increase in GFR and RPF but no consistent change in urine osmolality. The response was of short duration and the fraction of exogenous load excreted was less than 5% in five out of 7 infants. This study indicates that during the first few hours of postnatal life, the kidney of the newborn infant is capable of responding to water load as that of the older newborn. It can also be concluded that the transient postnatal diuresis observed in these infants could be partly due to the expansion of ECV by placental blood transfusion.

**254** CORRELATIONS OF GROWTH(G), LUNG PHOSPHATIDYLCHOLINE (PC), AND LUNG PROTEIN(PR) IN NEWBORN RABBITS. Alan H. Jobe, Machiko Ikegami and Harris C. Jacobs, UCLA School of Medicine, Harbor-UCLA Medical Center, Department of Pediatrics, Torrance.

Upon delivery, surfactant is released into the airway of newborn animals. However, changes in total lung (TL), alveolar wash (AW), and lung parenchyma (LP) PC, saturated PC (SPC), and LP PR have not been correlated with early neonatal G. We sacrificed 5 newborn rabbits per day taken from different healthy litters on days 1-12 of life. Following a standardized lung wash we measured in duplicate LP and AW PC, SPC and PR. Samples for the PC and SPC measurements contained <sup>14</sup>C-SPC to correct for losses in processing. The rabbits grew from 53±3 g to 240±20 g in 12 days (G curve: Y=51e<sup>0.1315t</sup>, r=0.986). TL PC increased from 131 µmoles to 34±4 µmoles by 12 days (PC curve: Y=11 + 3.87t - 0.16t<sup>2</sup>, r=.958). AW PC increased for only about 4 days, then the majority of the increase in TL PC was due to an increase in the LP pool. The LP PR increased from 78.2±2.9 to 194±23 mg by 12 days (PR curve: Y=84.8 - 9.2t + 3.8t<sup>2</sup> - 0.2t<sup>3</sup>, r=0.984). The curves for increases in G, PC, and PR are complex and nonlinear. However, for example, expressing AW PC and LP PC relative to weight results in linear curves (r=0.846 and r=0.930, respectively) that "hide" time dependent nonlinear changes in the pool sizes. However, SPC/PC in LP (0.340±0.003) and SPC/PC in AW (0.612±0.009) were invariant. While there are complex changes in pool sizes of protein and phosphatidylcholine relative to growth, the ratios of LP and AW SPC to PC are tightly regulated.

**255** PRENATAL METHADONE EXPOSURE: FACTORS AFFECTING SEVERITY OF WITHDRAWAL, Helen L. Johnson and Tove S. Rosen, Spon. by L. Stanley James, Columbia University College of Physicians and Surgeons, Dept. of Pediatrics, New York

There is conflicting evidence in the literature concerning the relation between maternal methadone dose during pregnancy and the severity of the withdrawal reaction experienced by the newborn. As part of an ongoing longitudinal study of children born to methadone-maintained mothers, 38 children exposed to methadone in utero were observed and their withdrawal evaluated and coded on a scale of one (mild) to 3 (severe) by a trained observer. The relation between severity of withdrawal and the maternal methadone dose (MMD) prior to delivery was not significant. The relation between birth weight (BW) and severity of withdrawal was also not significant.

	MMD (mg)	BW (gm)	Male	Female
MILD	$\bar{x}$ =39.32	$\bar{x}$ =2999.09	8	10
MODERATE-SEVERE	$\bar{x}$ =44.00	$\bar{x}$ =2813.67	15	5

The data indicated clear sex differences in severity of withdrawal (see above Table), with significantly more males having moderate to severe withdrawal reactions than females (x<sup>2</sup>=3.69, p<.07). This finding confirms developmental data indicating that males are more vulnerable than females to adverse environmental factors.

**256** HYPOXIC HYPOXIA (HH) AND CEREBRAL O<sub>2</sub> DELIVERY IN THE FETAL AND NEWBORN SHEEP. M. Douglas Jones, Jr., Adam A. Rosenberg, Raymond Koehler, Richard J. Traustman, Michael A. Simmons, and Richard A. Molteni. Departments of Pediatrics and Anesthesia/Critical Care Medicine, The Johns Hopkins University School of Medicine, Baltimore, Maryland.

The effects of HH on cerebral O<sub>2</sub> delivery and on the ratio between O<sub>2</sub> delivery and cerebral O<sub>2</sub> consumption, i.e. the cerebral fractional O<sub>2</sub> extraction, has been studied in 20 unanesthetized fetal sheep in utero and 7 newborn lambs. Cerebral O<sub>2</sub> delivery was calculated as the product of cerebral blood flow (CBF), measured with the radioactive microsphere technique, and arterial O<sub>2</sub> content (CaO<sub>2</sub>). Fetuses were studied as PO<sub>2</sub> varied from 12 to 35 mmHg; lambs, as PaO<sub>2</sub> varied from 30 to 150 mmHg. All data were corrected to a constant arterial PCO<sub>2</sub>. Neither cerebral O<sub>2</sub> delivery nor fractional O<sub>2</sub> extraction varied with PaO<sub>2</sub> (unless hypoxia was extreme) in either fetuses or lambs, despite wide differences in their physiologic circumstances. This suggests that the regulated variable during HH is (CBFX CaO<sub>2</sub>), not CBF. Since PaO<sub>2</sub> and CaO<sub>2</sub> are not linearly related, CBF must respond to changes in CaO<sub>2</sub> rather than PaO<sub>2</sub>. This indicates regulation of cerebral blood flow at the tissue level. Cerebral fractional O<sub>2</sub> extraction is relatively constant between fetuses and lambs despite considerable differences in cerebral O<sub>2</sub> consumption and delivery. Thus, the most important determinant of cerebral O<sub>2</sub> delivery is not developmental stage, but O<sub>2</sub> need.