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DOPPLER ULTRASONOGRAPHY IN NEONATAL BRAIN DEATH: ASSOCIATION WITH ABNORMAL TECHNETIUM CEREBRAL ANGIOGRAMS. John S. Gallagher and James A. Canfield. (Spon. by John Kattwinkel). University of Virginia Medical Center, Department of Pediatrics, Charlottesville.

Deterioration of Doppler-derived anterior cerebral artery flow velocities has been described in newborns with evidence of brain death (Ann. Neurol. 14:302-307, 1983). Since these changes suggest a progressive decrease in cerebral perfusion, we correlated sequential Doppler flow velocities with technetium cerebral angiograms in 2 asphyxiated neonates.

Case 1 was a 3800 gram term baby who developed lethargy and seizures within 24 hrs. of a difficult delivery. CT scan revealed cerebral edema and small subdural hemorrhage. Doppler flow studies (Medasonics D-10, 5 MHz probe) performed on day 3 showed retrograde diastolic flow. Peak systolic flow diminished on day 4. A technetium angiogram on day 4 showed markedly diminished cerebral perfusion and repeat study on day 9 after loss of all brainstem functions showed absence of intracranial circulation. Case 2 was a 3400 gram baby with severe birth asphyxia and seizures. CT scan revealed small ventricles and subarachnoid hemorrhage. Doppler flows were normal on day 1. Over the next 4 days, diastolic flow reversed and peak systolic flow diminished. Technetium study on day 6 showed absence of intracranial flow. Both patients expired.

These patients confirm the earlier association between a deterioration of Doppler flow velocities and clinical evidence of brain death. Lack of cerebral perfusion was documented with technetium angiograms.

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IMPAIRED COPPER UTILIZATION IN THE COPPER-DEFICIENT BRINDLED MOUSE MUTANT

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The Brindled mouse mutant is a model for the Kinky Hair syndrome. Male Brindled hemizygous suckling mice demonstrate poor growth and neurologic deterioration beginning during the first week of life and ending with death by the end of the second week. Newborn Brindled carriers are asymptomatic with normal brain copper concentration; liver copper concentration is low and the renal copper is high. Newborn carrier pups suckled by Brindled dams put on low copper diets on the day of parturition, however, show deficient weight gain by the age of 6 days and by 12 days weigh approximately one-half their normal litter-mates. Neurologic symptoms developed in the copper-deficient young carriers by age 12-14 days while their normal litter-mates remained asymptomatic. Tissue copper studies demonstrate that the liver and brain copper concentration in the carrier is no different from that of the normals, although the renal copper is greater than twice as high. On copper-deficient diets, the brain and liver concentrations of normal and heterozygous young decrease to comparable levels, but heterozygotes also develop systemic and neurologic symptoms. These observations are thought to implicate an abnormality in copper utilization in Brindled carriers brought out by marginal copper intake.

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RELATIONSHIP OF CSF BETA ENDORPHIN CONCENTRATIONS TO ONE MINUTE APGAR SCORE. Barbara Delivoria, Sheela Laungani, Alan Gintzler, Shing Wong, and Leonard Glass. Depts. of Pediatrics and Biochemistry, SUNY, Downstate Medical Center, Brooklyn, N.Y.

Concentrations of CSF beta endorphins were determined by a radioimmunoassay method in 23 neonates who underwent diagnostic lumbar puncture during the first 24 hours of life because of possible CNS infection. The birth weights of the infants ranged from 1.50 to 4.00 kg, with a median of 2.48 kg. The gestational ages ranged from 31 to 42 weeks, with a median of 36 weeks. One minute Apgar scores ranged from 2 to 9, with a median of 7.

The median endorphin concentration in infants with Apgar scores of 2 to 5 (N=8) was 154 pg/ml (range 96-236 pg/ml), while that of infants with Apgar scores of 6 to 9 (N=15) was 78 pg/ml (range 35-162 pg/ml). (p<0.01)

The linear regression equation, correlating CSF beta endorphin concentrations with one minute Apgar scores was  $y = 15.1x + 208.7$ ;  $r = -0.65$ ;  $p < 0.001$ . No relationship was observed between Apgar score and gestational age.

The highly significant inverse correlation between one minute Apgar scores (a reflection of fetal oxygenation status) and CSF endorphin concentration supports the hypothesis that perinatal asphyxia is associated with increased synthesis of endogenous opioids by the CNS. It may be speculated that this increased endorphin production is causally related to the respiratory depression observed in asphyxiated neonates.

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LACK OF RELATION BETWEEN DELIVERY ROUTE, PLACE OF DELIVERY, PRESENTATION AND INTRACRANIAL HEMORRHAGE IN <1500 GM. INFANTS: Margaret Go, Aruna Vade, Arun Narula, Tonse Raju, Dharmapuri Vidyasagar, Department of Pediatrics and Radiology, Chicago, Illinois.

The risk factors related with the occurrence of neonatal intracranial hemorrhage (ICH) are not fully understood. In 96 infants with <1500 grams birthweight from June, 1982 to July, 1983, we reviewed the ultrasound findings and correlated with the perinatal events to evaluate the relation of these factors with ICH. Radiologist (AV) was not aware of the clinical status. Gradings of ICH was done as was used by Papille, et. al. (1978). Results: The incidence of ICH (all grades) in <1500 grams infants was 59%. Incidence of Grade 3 or worse was 21%. One minute Apgar score between 0 to 3 was 30% in those with ICH, whereas, it was 10% in those without ICH. Other risk factors are shown in the table. (\*p=NS).

No. of infants with ICH	Mode of Delivery* Place of Delivery* Presentation*				
	Vaginal	C-section	Inborn	Outborn	Vertex Others
No. of infants w/o ICH	25	22	48	9	38 14
No. of infants w/o ICH	21	14	36	3	27 11

Data suggest: a) Although <1500 grams infants have high incidence of ICH, severe grades of ICH are still infrequent. b) In our population, there was no relationship between the mode of delivery, the place of delivery, or the presentation of infants during delivery with the occurrence of ICH. c) High incidence of low 1 minute Apgar Score in ICH infants suggests other perinatal events to be associated with ICH.

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NEUROMOTOR BEHAVIOR OF FULL TERM (FT) AND PRETERM (PT) INFANTS AT 3 & 6 MO. Delia I. Gorga, Francine Stern, Gail Ross (Spon. Alfred Krauss), Dept. Rehab Med., Ped. New York Hosp.-Cornell Med. Center, New York, N.Y.

A comprehensive Neuromotor Behavioral Inventory measuring motor tone, movement patterns, reflexes, environment, and oral motor behavior was used on 181 PT and FT infants born 1978-82 at 3 and 6 months. At 3 months, healthy FT infants had better quality of movement and were more advanced in motor skills than either healthy PT or ventilated PT infants. Healthy FT and healthy PT infants had little in common at this age except for the absence of abnormal responses. Some responses could be rank ordered such as head control, righting reactions, and blocks to movement. Best responses were seen in healthy FT infants, followed by healthy PT, and worst in ventilated PT infants. Ventilated PT infants had the greatest number of abnormal responses, greatest variation in behavior, and the least predictable sequence of development. At 6 months, FT infants continued to have better quality of movement and more advanced motor skills. Similarities between FT and healthy PT infants increased, particularly in muscle tone, sitting and the absence of blocks to movement. Ventilated PT infants had the highest incidence of abnormalities in tone, deviations in head and trunk control, and delays in motor skills (40%). This analysis of behavior demonstrates the predictability of neuromotor responses in healthy FT infants, the variability of development in healthy PT infants, the high incidence of abnormal development in ventilated PT infants, and provides a basis of knowledge of development of PT infants which may be used to discriminate between normal and abnormal high-risk FT and PT neonates.

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THE NEONATAL BAEP AS A PREDICTOR OF NEURO-DEVELOPMENT. Leopold Streletz, Makiko Kaga, Leonard Graziani, Christian Stanley, Hemant Desai. Departments of Pediatrics and Neurology. Thomas Jefferson University, Philadelphia, PA

Brainstem Auditory Evoked Potentials (BAEP) were recorded in 24 high risk neonates in the intensive care unit. The following risk factors were present alone or in combination in all subjects: birth-weight below 1500 gm, gestational age below 33 weeks, intracranial hemorrhage, birth asphyxia, respiratory distress syndrome, sepsis and seizures. The infants tested ranged in gestational age from 25-44 weeks. The BAEP testing was performed between 37 and 42 weeks post-conceptual age, using monoaural 70 dBHL rarefaction clicks presented at a rate of 11/sec. Serial recordings were obtained in all preterm infants. Wave I and V peak latencies and wave I-V interwave intervals were measured and compared to a group of 40 low-risk neonates. Abnormalities of one or more BAEP parameters were found in 10 high-risk neonates; at 18 to 24 months Bayley Scale scores were more than one standard deviation below the mean standard score for age in 6 of these infants, two of whom had cerebral palsy. However, 5 of 14 infants who had normal BAEP latencies in the newborn period were found at 18 to 24 months to have Bayley Scale scores more than one standard deviation below the mean for age. These findings indicate a lack of correlation between the BAEP latencies and neurodevelopmental outcome. Therefore, in contrast to results reported by others, we found no correlation between BAEP latencies in the neonatal period and neurodevelopmental outcome at age 18 to 24 months.