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NEONATAL DISORDERS

PATTERNS OF BRAIN INJURY IN HYPOXIC ENCEPHALOPATHY

Researchers at Imperial College, Hammersmith, London, UK, studied patterns of brain injury in term neonates with hypoxic encephalopathy, risk factors, and the correlation between neuroimaging abnormalities and developmental outcomes at a minimum of 12 months. Prenatal and perinatal data were compared with those for normal term low-risk infants. Among 500 term neonates with encephalopathy studied with MRI between 1992 and 2005, 48 had preceding acute hypoxia. MRI scans were obtained at a median age of 10 days, none > 6 weeks. Five patterns of brain injury were identified: 1) basal ganglia and thalamic lesions with severe white matter damage in 6 (14%); 2) basal ganglia and thalamic lesions with mild or moderate white matter changes in 24 (56%); 3) isolated thalamic injury in 2 (5%); 4) moderate white matter damage only in 1 (2%); and 5) mild white matter changes or normal findings in 10 (23%). Infants with patterns 1) and 2) showed internal capsule abnormalities in 93%, and 86% died or developed cerebral palsy. Infants with patterns 3) and 4) had developmental delay and diplegic cerebral palsy, respectively. Outcome was normal in infants with pattern 5). Risk factors included African ethnicity, and maternal plurality or hypertension. Birth complications included uterine rupture following previous cesarean section in 8 of 11 cases, and cord prolapse accompanying undiagnosed breech presentation in 4 of 9 cases. Basal ganglia and thalamic lesions in the MRI of term infants are indicative of neonatal hypoxic-ischemic encephalopathy. Patterns of central gray matter and secondary white matter injury are associated with poor outcome. Delivery should be expedited in infants at risk of sentinel events (eg. umbilical cord prolapse, placental abruption). (Okereafor A, Allsop J, Counsell SJ, et al. Patterns of brain injury in neonates exposed to perinatal sentinel events. *Pediatrics* May 2008;121:906-914). (Respond: Frances M Cowan MRCPCH, PhD, Department of Paediatrics and Neonatal Medicine, 5th Floor, Ham House, Hammersmith Hospital, Du Cane Rd, London W12 OHS, UK.)

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COMMENT. Abnormalities in the basal ganglia associated with perinatal asphyxia were described in clinical and neuropathological studies in the mid-20th century and earlier, especially in relation to cerebral palsy. (Norman RM. In: **Greenfield's Neuropathology**. Baltimore, Williams and Wilkins, 1963; pp. 390-397; Christensen E, Melchior J. Cerebral palsy – A clinical and neuropathological study. **Clin Dev Med** 1967;25:1; Ingram TTS. **Paediatric Aspects of Cerebral Palsy**. Edinburgh, E & S Livingstone, 1964). *Status marmoratus* (etat marbre), marbling of the basal ganglia is a well-recognized pathological finding in children with athetoid CP. Regarded initially as a prenatal developmental anomaly (Vogt C, Vogt O. **J Psychol Neurol** 1919;24:1, cited in Ingram 1964) etat marbre is now considered a sequel to perinatal birth anoxia, and associated with a history of asphyxia or trauma or, sometimes, kernicterus or status epilepticus. The thalami and other brain regions may also be affected. Characteristically, shrinkage of the basal ganglia is accompanied by coarse networks of myelinated nerve fibers, termed dysmyelination or hypermyelination. Stained by Weigert's method, the myelin marbled appearance is revealed as alternating light and dark areas in the putamen and caudate nuclei. Some well known pediatric neurologists have contributed to our understanding of the syndrome of status marmoratus and CP, including Crothers B. **Amer J Dis Child** 1921;22:145; and Ford FR. **Diseases of the Nervous System in Infancy, Childhood and Adolescence**. 4th ed. Springfield, IL. Charles C Thomas, 1960.

In the Hammersmith study report, status marmoratus is not mentioned as a possible pathology involving the basal ganglia of patients who developed athetoid cerebral palsy or in the 8 infants who died. Presumably, autopsies were not obtained. MRI descriptions of the basal ganglia abnormalities in the neonatal period showed swelling and homogeneous appearance, not shrunken and marbled. Status marmoratus may develop as a late finding in older CP patients. My colleague, Dr Mark Wainwright provided the following references to the MRI in patients with cerebral palsy: Mizuguchi M and Takashima S (**Neuropathology** 2002;22:85-89) report that radiological techniques are unable to visualize or identify pathological changes of status marmoratus; and reporting results of the European CP Study, Bax M and associates (**JAMA** 2006;296:1602-1608) found basal ganglia abnormalities in 12.8%, described as reduction in volume and increased signal in a child aged 18 months with dyskinetic CP. MRI obtained at 18 months of age or later was normal in 11% of children with CP.

PRE-TERM AND PERINATAL PREDICTORS OF NEONATAL HIPPOCAMPAL VOLUMES

Hippocampal volumes of 184 preterm (PT) and 32 full-term (FT) infants were measured by segmental MRI at term equivalent age in an investigation of correlations of preterm hippocampal volume, perinatal risk factors, and neurodevelopmental outcome, at University of Melbourne, Victoria, and other centers in Australia; St Louis and Boston, USA; and Geneva, Switzerland. No significant differences between PT and FT infant hippocampal volumes were detected, after controlling for head size. Factors associated with significantly smaller hippocampal volumes included white matter injury, exposure to postnatal steroids, and treatment with indomethacin. Smaller PT hippocampal volumes correlated with impaired cognitive and psychomotor development measured by the Bayley Scales at 2 years of age,