

neurotransmitter storage, mitochondria, cerebrovascular endothelial cells, astroglia and oligodendroglia. The ability of lead to substitute for calcium is a common factor in the mechanism of lead toxicity. Lead suppresses Ca-dependent release of acetylcholine, dopamine and amino acid neurotransmitters. Indirect neurotoxic effects include iron deficiency anemia, disruption of the blood-brain-barrier (BBB), disruption of thyroid hormone transport to the brain, substitution for zinc in zinc-mediated processes, and altered regulation of gene transcription.

A greater proportion of ingested lead is absorbed from the gastrointestinal tract of children than of adults, and the BBB permits more circulating lead to reach the brain of children less than 5 years of age. In contrast to IQ tests, more specific neuropsychological tests (eg attention, visuomotor integration, reaction time etc) are more sensitive to the effects of brain damage resulting from low levels of lead toxicity, and may be expected to uncover subtle cognitive signs of toxicity. Cognitive deficits due to lead are found to persist in to adulthood. Factors influencing the vulnerability of children to lead include socioeconomic status, dietary factors, genetic factors, and lead concentrations. Even with blood lead levels lower than 5 mcg/dl, there is an inverse relation between lead level and arithmetic and reading scores (Lanphear et al, 2000). The present threshold at which blood lead levels are considered to be unacceptable (10 mcg/dl) is too high. Once in the brain, lead cannot be removed by chemical chelating agents (Rogan et al, 2001), and the deleterious effects of lead on the developing brain cannot be prevented. The only prevention of adverse toxicity is prevention of lead ever entering the body. (Lidsky TI, Schneider JS. Lead neurotoxicity in children: basic mechanisms and clinical correlates. Brain January 2003;126:5-19). (Respond: Theodore I Lidsky, Center for Trace Element Studies and Environmental Neurotoxicology, NYS Institute for Basic Research in Developmental Disabilities, Staten Island, NY 10314).

COMMENT. There are accumulating research data showing that toxic effects of lead on learning and behavior occur at levels of lead much lower than the currently accepted threshold of 10 mcg/dl adopted in 1991. It may be argued that there is no 'safe' level of lead.

ATTENTION, LEARNING AND COMORBID DISORDERS

NEUROMOTOR INCOORDINATION PREDICTIVE OF ADHD

Quantitative and qualitative motor performance on the Maastricht Motor test was evaluated in 401 children ages 5 to 6 years (232 males, 169 females) who were tested 18 months later for attention deficit hyperactivity disorder (ADHD) and ODD/CD, in a study at the University Hospital of Maastricht, Department of Neurology, the Netherlands. Thirty-five children were diagnosed with ADHD and 26 also had ODD/CD. Two of four qualitative motor domains (dynamic balance and diadochokinesia and manual dexterity) and the total qualitative score for motor performance at 5 to 6 years of age were predictive for the diagnosis of ADHD 1 year later, but not for ODD/CD. Both gross and fine motor performance impairments were predictive, but only qualitative test performances showed significant correlations with later diagnosis of ADHD. (Kroes M, Kessels AGH, Kalff AC et al. Quality of movement as predictor of ADHD: results from a prospective population

study in 5- and 6-year-old children. *Dev Med Child Neurol* Nov 2002;44:753-760). (Marielle Kroes MD PhD, University Hospital of Maastricht, Department of Neurology, PO Box 5800, 6202 AZ, Maastricht, the Netherlands).

COMMENT. The significance of motor performance as an indicator of attentional problems and ADHD has been stressed by previous investigators. Denckla (1973,1974) and Denckla and colleagues (1985) used speed of motor function in repetitive tapping movements of finger, hand, and foot to assess motor performance in normal children and children with dyslexia with and without attention problems. Children with ADHD were significantly slower in motor function than controls.

Huttenlocher et al, (1990) found that "soft" neurologic signs were of predictive value for learning disabilities in preschool children, aged 3 to 5 years. A poor neurologic test score at age 5 years correlated with a lower Full-Scale IQ at age 7, and neurologic soft signs accurately identified almost all the children who needed special educational services. Soft neurologic signs and so-called "minimal brain dysfunction (MBD)" have previously been correlated with symptoms of ADHD and a beneficial response to stimulant medication (Millichap, 1974; see Attention Deficit Hyperactivity and Learning Disorders (PNB Publishers, 1999).

The present investigators evaluated both quantitative and qualitative aspects of motor performance, using the Maastricht Motor Test (MMT). The MMT includes 70 items organized in 4 domains: static balance (stork position), dynamic balance (hopping), ball skills (number of catches), and diadochokinesia and manual dexterity (speed of tapping the hand). Qualitative aspects of motor performance were predictive of ADHD in 5- to 6-year-old children.

Early motor skills and language development in at-risk dyslexic children. In a Finnish study of 88 children with familial risk for dyslexia cf 88 without risk, children with familial risk for dyslexia and slow motor development had a smaller vocabulary and spoke in shorter phrases at 18 and 24 months than other children. (Viholainen H, Ahonen T, Cantell M et al. *Dev Med Child Neurol* Nov 2002;44:761-769).

ADHD COMORBIDITY, BEHAVIOR, AND TIC SEVERITY

The association of disruptive behavior with social, adaptive, and family functioning in Tourette syndrome (TS), with and without comorbid attention-deficit/hyperactivity disorder (ADHD), was evaluated in 207 children (144 boys and 63 girls) between the ages of 7 and 18 years, in a study at Yale University School of Medicine, New Haven, CT. Children with TS-only (n=42) did not differ from unaffected controls (61) on the parent ratings of aggression and delinquent behavior or on the teacher ratings of conduct disorders. Children with TS+ADHD (n=52) had significantly greater ratings of disruptive behavior than controls and similar to children with ADHD only (n=52). Aggression and delinquency contributed to impaired social and family functioning. Comorbid ADHD is highly associated with disruptive behavior and functional impairment in children with TS. Disruptive behavior adds to the burden of social and family dysfunction. (Sukhodolsky DG, Scahill L, Zhang H et al. Disruptive behavior in children with Tourette's syndrome: association with ADHD comorbidity, tic severity, and functional impairment. *J Am Acad Child Adolesc Psychiatry* January 2003;42:98-105). (Reprints: Dr Scahill, Yale University