Brain Function Decline in Children with AIDS

Many AIDS-related brain abnormalities are similar in children and adults, but children often have an unusual calcification of brain tissue

Only within the past 18 months have scientists been able to show that the virus causing acquired immune deficiency syndrome (AIDS) directly infects the brain. About 60% of adult AIDS patients will develop dementia, and "neurological problems in children with AIDS may be even more common than in adults," says Anita Belman of the State University of New York in Stony Brook.

"Some children have normal head circumferences at birth, but their brains often do not grow at the rate they should," says Belman. Many do not learn and develop motor skills at the normal times. In her report at the recent meeting of the American Academy of Neurology in New Orleans,* Belman also described an unusual feature of their brain damage.

Children with AIDS frequently have calcification of the basal ganglia. There are abnormal mineral deposits in blood vessels that supply the gray matter lying deep under the cerebral cortex on both sides of the brain. Belman and her co-workers, George Lantos, Dikran Horoupian, Brian Novick, Monica Ultmann, Dennis Dickson, and Arye Rubinstein at the Albert Einstein College of Medicine, detect the abnormal calcification in living patients with computerized tomography (CT) scans of their brains.

In 1983, when only 15 children were reported as having AIDS, Belman began studying the developmental and neurological problems associated with their disease. Today, the number of children with AIDS is nearly 300, more than 40 of whom are included in Belman's study. She follows the development of their motor and mental abilities as long as possible and correlates it with their neurological problems.

Normally, children learn to roll over, sit up, stand, say single words, walk, combine words, and so forth, at fairly predictable ages. But in children with AIDS, there are changes in this normal developmental progression that Belman thinks fall into definable categories.

Some children with AIDS develop normally for several months to a year, and then follow a "slow, stuttering course of brain disease that plateaus for periods of time," says Belman. For instance, she describes one child who could stand with assistance when she was a year old. By 16 months she had a kind of lung infection that frequently accompanies AIDS, and for the next 8 months did not acquire any additional language or cognitive skills. At 2 years of age she got another infection, which was treatable, but then regressed to the developmental level of a 7- or 8-month-old infant.

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Other children seem to get progressively worse at a slow rate without any plateaus, and still others become very sick very rapidly. Another AIDS patient, a 10-year-old boy with hemophilia, was an intellectually gifted student. Four months after he began showing signs of brain abnormalities, he was only able to follow one-step verbal commands. He had brain atrophy and calcification in the region of the basal ganglia on both sides of his brain.

Most of the children evaluated by the New York researchers were born to mothers with AIDS or in a group at high risk for AIDS. A few are hemophiliacs and presumably got the virus from infected blood. In her new study, Belman followed 16 of these children, 8 girls and 8 boys. All of them had bacterial or other viral infections that frequently accompany AIDS, and all had circulating antibodies to the AIDS virus.

Many children with AIDS have brain atrophy or shrinkage, a problem that Belman thinks "is probably due to changes in white matter." Adult AIDS patients also have abnormalities in the white matter (nerve fiber tracts covered by white myelin sheaths). And, like adults, children show signs of dementia if they live long enough.

Adults with AIDS frequently have abnormal fused clumps called multinucleated giant cells in their brain tissue. Much of the virus in adult brains is associated with these cellular clumps, according to new information from Anthony Fauci and his colleagues at the National Institute of Allergy and Infectious Diseases, and Richard Price and his co-workers at the Memorial Sloan-Kettering Cancer Center. Belman and her New York colleagues see multinucleated giant cells in some children's brains, but they have not yet found virus particles in any of the brain tissues from children with AIDS.

It is very difficult to compare the incidence of brain impairment in children and adults with AIDS, because there are no studies that follow both groups over long periods of time. Belman and her colleagues have not studied a sufficiently large number of children to be able to identify precisely what percentage will develop AIDS-related brain damage.

Many questions about how AIDS affects a child's brain remain to be answered. For example, how much of the brain damage in children is due directly to the AIDS virus and how much results from other infections, or from metabolic or hormonal disturbances? And why do the blood vessels in the basal ganglia, as opposed to other brain regions, become calcified?

Calcification of brain tissue is not unique to infants with AIDS. For instance, older children who have Down's syndrome, certain metabolic disorders, hormonal disorders, or infections can develop brain calcification. Also, aged adults typically show the calcification. But Belman's findings that calcification is localized primarily in the region of the basal ganglia, that it occurs symmetrically on both sides of the brain, and that it appears in infants are a combination of features particularly associated with AIDS.

Although Belman cannot pinpoint the cause of basal ganglia calcification in children with AIDS, she thinks it may be due to "some damage to the endothelial cells lining the blood vessels" in this brain region. She says, "I think that the immature nervous system may be more susceptible to injury, whether it is by the AIDS virus or metabolic derangements. Some children have a wasting syndrome, even when you are giving them parenteral [outside the intestine] nutrition. They have signs of losing fat and protein and, in a developing nervous system, this may play a very big role." ■

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*Annual meeting of the American Academy of Neurology, 26 April to 3 May 1986, New Orleans, Louisiana.