Imaging the Effects on the Brain of Alcohol Use in Pregnancy

By Claire D. Coles, Ph.D.

Since Fetal Alcohol Syndrome (FAS) was described in 1973, scientists and health care providers have known that heavy use of alcohol in pregnancy can cause damage to the Central Nervous System. It is this damage to the brain that is believed to be responsible for the learning and behavior problems that are often seen in infants and children who have been exposed to alcohol. Research using animal model, which allows exposure to higher levels of alcohol than usually occur in humans, has confirmed that there are specific nervous system malformations and unusual growth patterns resulting from alcohol exposure. A few postmortem studies of infants and children who died from other causes suggested that alcohol caused brains to be smaller than normal and to have certain malformations. However, it has not been possible until recently to study the brains of living people and to understand the relationship between the activities of the nervous system and the behavior of individuals.

In the last decade there have been significant advances in neuroimaging using neuromagnetic resonance imaging (MRI) procedures. These procedures use a powerful magnet as well as sophisticated electronics and statistics to provide a picture of the structure and function of the living brain. Initially MRI was used clinically to identify lesions and other structural problems in the brain that led to medical problems. More recently, functional MRI (fMRI) has been used to study the process that goes on during memory, attention and other activities of the brain.

In the last few years, several centers have used this powerful technique to study the effects of prenatal alcohol exposure. Studies from San Diego (Sowell, et al. 2001)
have found that patients with FAS have less white matter than do normal individuals. Since white matter helps to ensure the efficiency of the transmission of nerve impulses in the brain, having a reduced amount may explain some of the learning difficulties that result from alcohol exposure. Recently, the Maternal Substances Abuse and Child Development Laboratory, Department of Psychiatry and Behavioral Sciences has collaborated with the Biomedical Imaging Technology Center, both at Emory University, to study young adults who were exposed to alcohol prenatally. An initial study using a technique called Diffusion Tensor Imaging (DTI) has found that alcohol-exposure is associated with reduced efficiency in the corpus callosum, the large bundle of white matter fibers that connects the two hemispheres of the brain (Ma, et al, 2003). With a new grant from the National Institute on Alcoholism and Alcohol Abuse (NIAAA), we will use these methods in the future to study other patients and to understand the relationship between these changes in brain structure and their behavior. These studies will establish the basis for some of the deficits seen in individuals with FAS and may be helpful in future treatment and educational planning.

For further information regarding this article please contact Claire D. Coles, Ph.D. at the Maternal Substance Abuse and Child Development Project, Emory University School of Medicine, Department of Psychiatry and Behavioral Sciences, 1256 Briarcliff Road, N.E., Suite 309W, Atlanta, Georgia, 30306. You can also phone us at 404-712-9800 or visit our website at http://www.emory.edu/MSACD

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References:
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