Brain Imaging in Preschool-Aged Children Reveals Potential Markers of ADHD

An interview with E. Mark Mahone, Ph.D.

Understanding the complex pathophysiology and behavioral trajectories of Attention-Deficit/Hyperactivity Disorder (ADHD) has been a long-term interest of Dr. E. Mark Mahone, Professor of Psychiatry and Behavioral Sciences at the Johns Hopkins University and Director of Neuropsychology at the Kennedy Krieger Institute. Dr. Mahone's earlier imaging work in ADHD revealed sex differences in cortical development that varied by age. Specifically, he found more brain abnormalities and worse behavioral profiles in school-aged boys relative to girls, despite a similar onset in their preschool years.

These findings prompted a new line of research that specifically focused on characterizing ADHD in young children to determine whether symptom and functional profiles are associated with development and change in the brain over time. Funded by the NIH, Dr. Mahone and his group began a large project examining 4-year-old children with ADHD symptoms using both behavioral and brain imaging data. Despite the unique challenges associated with studying preschoolers (e.g., staying still in the scanner), Dr. Mahone and colleagues have implemented creative strategies, such as using behavioral desensitization, reinforcement and "nap time" to deal with these issues and collect detailed information.

One of the most interesting findings from Dr. Mahone's recent study was published in JINS (Jacobson et al., 2018) and noted the presence of wide-spread cortical reductions primary in subregions of the frontal lobes including motor, premotor, and orbitofrontal areas. This was somewhat surprising as it was initially hypothesized that brain differences would be small and subtle given the age of the participants. However, "they were pretty striking," says Dr. Mahone, "and many of those reductions were predictive of the severity of their ADHD symptoms." What the findings reinforce is that "even by age 4 years there is something biologically different about these children who present with ADHD," says Dr. Mahone.

While developmental conditions, such as ADHD, can be difficult to characterize, Dr. Mahone and his colleagues' work have demonstrated brain changes are observable early in their developmental course. "Likely from birth," says Dr. Mahone, "we know it has a significant genetic component, but now we can observe that by age 4 years their brains are developing very differently – they are on a different trajectory."

Part of the clinical challenge is being able to screen early for ADHD, which can trigger appropriate interventions and increase the chances of improving functional outcome. While regularly done for other developmental disorders such as autism, for ADHD "there is the prevailing wisdom you just let it go till school-age," says Dr. Mahone. New guidelines from the American Academy of Pediatrics outline procedures for identifying and treating ADHD in preschoolers, but Dr. Mahone believes screening should happen even younger.

For the future, Dr. Mahone plans on continuing to examine the wealth of data collected from the study, including white matter integrity, cerebellum structure, motor, cognition and other behavioral functions. Overall, he anticipates being able to track the trajectory of these changes using longitudinal methods and follow these children into adolescence to further characterize the pattern, extent, and severity of ADHD symptomatology.

For more information about Dr. Mahone's research, follow the link to listen to the interview with Dr. Derin Cobia:
https://www.the-ins.org/files/newsletter/summer_2018/Lk_Mahone_interview_Summer_2018.m4a