

Towards a Deeper Understanding of ADHD: The Role of Frontal Lobe Dysfunction

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Introduction

It is estimated that 5-10 percent of children and adolescents meet criteria for ADHD, making it one, if not the most common, disorder of childhood. Despite this, ADHD can still be missed in children. We are all comfortable and familiar with diagnosing the disruptive and hyperactive boy. However, being able to diagnose the more subtle and milder forms of ADHD, early on, can be difficult and confusing. Making it more cumbersome is the fact that there are many children with ADHD who may not present with academic or disruptive issues but other symptoms such as anxiety, school phobia, or depression. Accurately diagnosing these children is critical, as treating a child's ADHD with anxiety or antidepressant medication, in the absence of comorbidity, will be ineffective. The question then is how do we become more adept at recognizing children with ADHD across the spectrum, not just at the extremes?

The Executive Functions of the Frontal Lobe

In order to understand just how complex of a disorder ADHD is, it is first important to understand how exactly the frontal lobes work. Once you have an appreciation for the many and varied roles that our frontal lobe plays in our brain, it becomes much easier to recognize those children with executive function issues. The frontal lobe comprises the front third of the brain. I often tell students and residents I teach that "You can live without your frontal lobe (i.e., breathe/move) but you can't *function* without it."

Information Processing

Many of us take our frontal lobe for granted, as it does all of the "automatic," day-to-day functions that we don't consciously think about. In addition to helping us focus and pay attention to a task, our frontal lobe also helps keep us from being distracted from extraneous and irrelevant stimuli. Parents will often describe their child with ADHD as "hypersensitive" to their sensory environment. For some of these children, this can be so significant as to even take the form of a separate "sensory integration disorder." Often, from infancy, these are children who startle easily with loud noises, may have issues around the textures of foods and clothing, and have sensitivity to touch. The way to describe the experience of the world of a child with ADHD is that it is like they have a

“megaphone” to their ear all the time and are hearing things around them at “high definition.” The medications (i.e., stimulants) allow kids to “tune down” the volume around them and not get so distracted and “bothered” by extraneous stimuli and noises. It is understandable therefore, that many of these children are so easily frustrated and irritated by others that they literally can’t think because of all the “background” noise that is present for them.

Our frontal lobe also helps us process information that we receive and “holds” bits of information we need while we are trying to figure something out. This can be seen on testing and is one of the most concrete ways of documenting a child’s ADHD. Termed “executive dysfunction,” children with ADHD will often show discrepancies between their Verbal (VIQ) and Performance (PIQ) IQs (i.e., Language [usually “left” brain] and Nonverbal [“right” brain]) and their Processing Speed (PS) and Working Memory (WMI). Often the PS and WMI will be several points below their VIQ and PIQ, speaking to the “extra time” it takes their frontal lobe to complete tasks and their inability to manipulate multiple pieces of information at one time. Therefore, parents and teachers will comment that the child is “forgetful” and disorganized. Children and adults with ADHD will complain of “poor memory” and feeling that they have “a million thoughts” in their head. In a child who seems to be visually struggling with attention and concentration, these discrepancies can cause significant impairments, especially as they enter higher grade levels and the organizational demands expected of them increase. This can sometimes fool parents and teachers, as the child may actually present with more school anxiety and phobia and, especially when a child has previously done academically well, not appear to have issues around learning and ADHD.

Impulse Control

Our frontal lobe is responsible for controlling impulses, has a strong role in our emotional regulation (ventral medial and orbital frontal portions), motivation, organization, and “sequential memory.” Through its connections with the limbic system (nucleus accumbens and amygdala), the anterior portions of the frontal lobe are responsible for our fear response, risk taking, and emotional decision making. Studies have shown that the nucleus accumbens (which is associated with rewards system in the brain) in children with ADHD is often underdeveloped and may play a role in the high risk-taking behaviors that are often found in this population, including substance abuse.

There have also been several studies that have connected anterior orbital portions of the frontal lobe with schizophrenia, bipolar disorder, and OCD. It is not surprising therefore that many of these children go on to struggle with significant “mood” issues, and it is estimated that up to 50 percent are at risk of developing a mood disorder by adolescence. Even in the absence of a mood disorder per se, parents will often describe

their child as “moody,” easily frustrated, and unpredictable. Unlike a mood disorder, these symptoms are often present from early on (early childhood), and parents may even describe their child as having been “colicky” or having a history of frequent temper tantrums from the time they were toddlers. They are kids who may have had difficulty self-soothing as infants. Their moods don’t take the form of discrete periods (i.e., days to weeks) but are described as changing on a “moment-to-moment” basis and often dependent on their environment. Kids with ADHD have mood *reactivity*, and therefore their moods depend on what is going on around them.

Many of these children will be described by those around them as being “melodramatic,” and this can lead to significant familial and peer-related conflicts. Because of issues with impulsivity, poor decision making, and inattention, many of these children struggle with being able to pick up nonverbal social cues from their environment. As a result, they often get themselves into trouble with others without even being aware of it. Long-term studies show that children with ADHD have higher rates of early marriages, pregnancies, divorces, dropping out of high school, domestic violence, and substance abuse. Although tricky at times, the stimulants should and often do help with many of the mood symptoms associated with ADHD. There are times however, when a physician may have to try a few different stimulants to find the “right one” for a given child, as some of the stimulants for particular children can effect their mood negatively (i.e., irritability or blunting).

Motivation

The frontal lobe plays a key role in motivating us to do things. This is best demonstrated by looking at patients from the late nineteenth century who had frontal lobotomies. In these procedures, a small portion of the inferior portion of the frontal lobe was removed to disconnect portions of the limbic from the frontal lobe in agitated or aggressive patients. Patients who were previously aggressive, combative, or labile would post-op become docile and “apathetic.” Often, they would just sit in a room all day and, without prompting, do nothing. It was not that they *couldn’t* do anything; it was that they lost their *interest and motivation* to do so. How often do we hear that kids with ADHD are “just lazy” and “they could if they wanted to.” Parents, teachers, coaches, and everyone around them says it without really understanding what they are saying. They see it as kids being *volitional*, when in fact it is that kids with ADHD are often *fighting against their frontal lobes’ inability to “get them started.”* As a result, they frequently “procrastinate” and put tasks off. It may take a great deal of interest or stimuli for kids with ADHD to move past this disability.

There are times however, when if something does hold their interest, they can get *overly* focused on it. This speaks to our frontal lobes’ role in not only helping us pay attention but also *shift* our attention when needed. Therefore, kids with ADHD can be rigid, perseverative, and “obsessive” even in the absence of comorbid OCD or PDD.

How many times have we heard parents complain about their child's "obsession" on the computer or video games and how difficult it can be to get child to stop once they engage in these activities?

Automatic Memory

Although our frontal lobe doesn't hold "factual/long-term" memory, it does hold a very important kind of memory - "automatic" memory. These memories are the things you do every day but take for granted as requiring memory. We don't think about making a cup of coffee as requiring memory, but it does. There are steps to making coffee that you need to do in order to make a pot of coffee. Missing one of these steps will cause an error in the whole process. Think about the patient who is developing dementia. He or she often begins to struggle with daily functions of living - getting lost in their own neighborhood, forgetting to shut off the stove - and this causes significant dysfunction for him or her. This is because he or she loses his or her ability to use the frontal lobe effectively. Likewise, kids with ADHD may struggle with poor ADLs and daily skills because they lack this ability.

Summary

With all of the varied functions that our frontal lobe is responsible for, it is not surprising that children with ADHD therefore can present with more than just attention and hyperactivity symptoms. It is important to carefully look for underlying learning issues when confronted with children who are struggling in the community. Having a clear understanding of frontal lobe functioning enables us to make sure children get the timely treatment that they need.