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REPORT

How A better understanding of ADHD leads to new approaches in treating the disorder

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J. is a restless nine-year-old boy who tries to avoid school. When in class he squirms in his seat, interrupts his classmates, stands up unexpectedly and shouts out answers that in most cases are wrong. J. may start school assignments but rarely finishes them. Most of the time he roams around the classroom not knowing what to do. He is often not picked out to play baseball and tries to spoil the game. Unpredictable in his movements, J. suddenly does outrageous things. His most recent act was to swing from the fluorescent light fixture over the blackboard, having climbed there between classes. He was still there when class began, causing an uproar as he could not get down.

But J.'s parents noted strange behavior long before that. At the age of three, J. needed little sleep. He would get up at four o'clock in the morning, before anyone, dash downstairs and "demolish everything." Sometimes he managed to unbolt the front door and run into the busy street, frightening his helpless parents. J. disliked toys and games that needed

concentration, had no interest in TV, was unpopular with other children and often stole from home and from other children.

J. has a clinical condition called attention deficit/hyperactivity disorder (ADHD). The examining physician described his attention span as "non-existent." Subsequent treatment with drugs improved some of the symptoms though not all. However, to the relief of his parents and teachers, J. was less impulsive, less restless, more attentive and more obedient.

What is ADHD?

It is estimated that 2% to 20% of American school children suffer from attention deficit/hyperactivity disorder (ADHD), the most common of the childhood psychiatric disorders. The syndrome is characterized by distinct patterns of disruptive behavior. The main symptoms of ADHD include reduced attentiveness and concentration, a short attention span, easy distractibility, impulsive behavior, and age-inappropriate excessive activity (hyperactivity). Children with attention deficit/hyperactivity disorder are hard to manage. They are disruptive at home and at school, have trouble in reading and writing, and often fail in their studies.

In general, normally active children show impulsive and aggressive behavior from time to time. They may also have a short attention span in class because of a boring teacher. Because of this, the diagnosis of a child as having ADHD is specific and well defined. When suspicion arises that a child may have ADD (Attention Deficit Disorder) or ADHD the correct clinical diagnosis depends on the observed symptoms that meet certain diagnostic criteria. That is, the disorder must be present for at least six months, cause dysfunction in learning or social behavior, or both, and occur before the age of seven. Symptoms must be seen in two separate settings, for example, school and home. A child who has only symptoms of inattention, or shows only hyperactivity and impulsivity but not inattention, may be diagnosed as having ADHD. Together the symptoms occur in as many as 10% of boys and 5% of girls. The disorder declines with age, though up to 65% of hyperactive children still have the symptoms as adults. Theories on the origin of the disorder have suggested it to be a genetically based condition. However, no single factor is currently believed to be the cause of the disorder, and many environmental factors-including diet-may contribute to it.

Epidemiology

Attention deficit/hyperactive disorder has been known for many years under different names as reported in the medical literature. In the early 1900s, impulsive, uninhibited and hyperactive children were grouped under the label "hyperactive syndrome." In the 1960s, children with poor coordination and learning disabilities were defined as having "minimal brain damage."

Though in the United States the incidence of ADHD ranges from 2% to 20%, a conservative number is about 3% to 5% for pre-puberty age elementary school children. In Great Britain the incidence is lower, less than 1%. Boys have a greater incidence of ADHD than girls, the ratio being from 3:1 to as much as 5:1. The disorder is most common in firstborn boys. Although the beginning ADHD occurs around the age of three, the child is usually diagnosed only when entering elementary school. At that time, the learning situation requires concentration, attention span and submission to a structured environment in which a child must sit in an

assigned seat for long periods and listen. Being in school tests the child's learning abilities as well as social interactions with classmates.

Possible causes

The real causes of attention deficit/hyperactivity disorder are not known, though several have been suggested. Most children with ADHD do not show any obvious structural damage in the brain, but a number of factors are thought to contribute to the disorder. These include hereditary factors and exposure to toxic substances and mechanical damage to the nervous system, before birth or early after.

Genetic factors

Evidence for a hereditary basis for ADHD includes the finding that there is a higher incidence of the disorder in twins who developed from one egg than in twins who developed from two eggs. Also, brothers or sisters of hyperactive children have about twice the risk of having the disorder as do other children. Biological parents of children with the disorder have a higher incidence of ADHD than do adoptive parents of ADHD children. Parents of ADHD children are often hyperactive, non-social and may have higher rates of alcohol-use disorders when compared to parents in the general population.

Brain damage

It has long been theorized that some children with ADHD received minimal and subtle injury to the brain sometime during their fetal or pre-birth period. Subtle brain injury in the developing child may also occur during pregnancy due to poor maternal circulation and a reduced oxygen supply, or by toxic substances produced in metabolism or from external sources. Animal studies show that maternal stress during pregnancy affects behavior in offspring. The same effects may occur in humans. Psychiatric studies show that mothers with high anxiety levels are likely to give birth to babies who are hyperactive.

Brain injury may also occur after birth, in infancy, due to infections, inflammation and physical trauma. All these factors can cause minimal and subtle changes in the brain that are not even seen clinically but are responsible for the development of learning disorders and ADHD.

Efforts to discover structural or functional changes in the brain of ADHD patients have yielded mixed results. Head scans by computed tomography (CT scans) show no consistent findings of obvious damage.

Studies using another imaging technique, positron emission tomography (PET scans), found decreased blood flow and a lower degree of metabolism in the frontal lobe of the brain, the area that controls attention, activity, learning, social judgement and movement. It is suggested that the changes seen in the frontal lobe by the PET scan may be related to symptoms observed in ADHD. For example, a reduction in signals sent from the frontal lobe to control activity would result in the hyperactivity seen in the children.

Neurochemical factors

Chemical neurotransmitters are communication molecules in the brain. A neurotransmitter is released from one nerve cell and taken up by another. Dopamine is one of the neurotransmitters whose low levels appear to be linked to ADHD. This is suggested by findings that medications known to improve some of the symptoms of the disorder increase the levels of dopamine in brain cells. Currently, not one but many neurotransmitters are thought to be involved in the development of ADHD.

Social factors

Children in orphanages and other like institutions are often overactive and have poor attention spans. These conditions result from prolonged emotional deprivation. When the children are no longer starved for affection, either via adoption or entry into a happy foster home, the symptoms disappear. In other cases, stressful family situations, psychological trauma, a disruption of family life and other anxiety-producing conditions contribute to the onset or continuation of ADHD.

Other factors that must be taken into account are the child's temperament, genetic factors and the need to conform to certain patterns of behavior and performance in society.

Is diet a cause?

For the past 20 years or more, parents of hyperactive and hard-to-manage children have been bombarded with claims that many of the common foods we eat or substances added to them are the cause of their child's hyperactive behavior, and in cases of ADHD, the cause of the syndrome. The food products thus targeted include sugar, artificial sweeteners, food additives, preservatives, berries and tomatoes, as well as those that may trigger allergic reactions in children such as milk, wheat, corn and chocolate.

Since a number of studies could not find a significant connection between diet and ADHD, health organizations did not accept these claims. While food may influence behavior, the underlying causes of ADHD are multiple in origin.

Nutritional approaches

Dietary intervention

Dietary interventions are approaches that may help certain children. They have not been proven as a standard therapy and require more research to determine their effects. Because of the association found in some cases between eating certain foods and hyperactive behavior, it is perhaps worthwhile to try to modify a child's diet. The latter especially applies in cases of unresponsiveness to other forms of therapy, or if a child suffers from the side effects of stimulants.

In dietary intervention, a child with ADHD may be given a restricted basic diet that has no food additives or preservatives, little or no sugar and has no foods that are known to produce allergic reactions in some people, such as chocolate. If such a diet reduces hyperactivity and improves behavior, new food items may be added back one at a time to monitor a food that triggers negative behavior and identify the culprit. Another way is to eliminate different foods one at a time from a regular diet and see if there is any improvement in behavior.



Nutritional supplements

A few small studies suggest that ADHD children may be deficient in specific nutrients and that in some cases supplementation may improve some of the symptoms of the disorder and decrease hyperactivity.

In a study reported from Poland a group of 116 children diagnosed with ADHD showed a deficiency in magnesium, copper, zinc, calcium and iron when compared to healthy children. The shortage in these minerals, as detected in blood tests and by hair analysis, occurred more often in hyperactive children. Magnesium deficiency was found most frequently.

In a second study from the same medical institute, 50 children with ADHD who were magnesium deficient received magnesium supplements of 200mg/day for six months as compared to control ADHD children who were magnesium deficient but did not receive supplements. At the end of six months the researchers found an increase in the magnesium content of hair and serum and a significant decrease in hyperactivity compared to the control group.

Other nutritional factors may also play a role. Some children with ADHD show symptoms of fatty acid deficiency, with reduced levels of n-3 fatty acids and n-6 fatty acids. The 1995 study, published in the American Journal of Clinical Nutrition, found that 53 children with ADHD had altered fatty acid metabolism and a significant lower level of key fatty acids in the plasma lipids and in red blood cell membranes. Fatty acids are important components of cell membranes including brain cells. Though there is no proof, and it is difficult to determine when the deficiency began, it may be that reduced levels of certain fatty acids may be related to the mental condition of the ADHD patients. Would supplementation of fatty acids in the diet of ADHD patients help improve symptoms of the disorder? Only future studies will tell.



Recognizing ADHD

Attention deficit/hyperactivity disorder may have its beginning in infancy. Infants with ADHD are easily upset by noise, light, temperature and other environmental changes. Sometimes the reverse occurs and the children are unusually calm and limp, they sleep much of the time and develop very slowly in the first few months. On the whole it is more common that infants with ADHD are active in the crib, sleep little and cry a lot.

Children with ADHD have mood swings, are easily set off to laughter or to tears and are irritated to an explosive degree by minor occurrences, that often puzzle and dismay them. About 75% of children with ADHD show aggression and defiance. As they grow, ADHD children must watch as the other children, but not they, grow out of some of the hyperactivity and impulsive behavior. The negative self esteem and reactive hostility already present are worsened by the children's recognition that something is wrong and that they have a problem.

In school, communication disorders, short attention span and distractibility hinder their ability to learn. Frustration over their failure to learn, their difficulties in reading, in mathematics and in expressing themselves in writing further deepens the loss in self esteem and leads to depression.

ADHD is a persistent condition, not an episodic illness. The disorder begins early and worsens with time. Some children show a

lessening of symptoms as they reach puberty; sometimes the symptoms disappear. Those who do not improve with time may require treatment and need to learn strategies to enable them to do their work and get along with other people for the rest of their lives.

Treatment Pharmacotherapy

Current treatment consists of a two pronged approach: medication and behavior therapy. The first drugs of choice in treating ADHD are brain stimulants. These include primarily Ritalin (methylphenidate), Dexidrine (dextroamphetamine) and Cylert (permoline). The FDA approves Dexidrine in children three years and older and Ritalin in those six years and older. The latter two are the most commonly used drugs.

The exact mode of action of these stimulants is unknown. Although the idea of using a stimulant to treat a hyperactive child seems paradoxical, it works. Stimulants such as Ritalin increase the level of catecholamine neurotransmitters such as dopamine by stimulating its release and by blocking its reabsorption back into the cell (reabsorption stops dopamine action). In this way, the stimulant enables the neurotransmitter to stay longer in the area of importance in the brain where it is needed.

Ritalin has been shown to be highly effective in more than three quarters of all children with ADHD, but it does have some side effects: nausea, headaches, stomachaches and reduced ability to sleep.

Ritalin is a short acting medicine. Administration of the drug is usually timed to produce maximum effects during school hours, so that children under the influence of Ritalin will stay in the classroom and attend to their school work. In one study, 75% of hyperactive children treated with Ritalin showed improved attention in the classroom and in their school achievements.

Children who take Ritalin or other stimulants are less impulsive and more attentive in the classroom and in social situations. The medication increases the child's ability to stay focused and reduces explosiveness, hyperactivity and irritability. There is no evidence that the medication directly improves learning disorders, but as attention increases following medication and other symptoms improve, the child learns better.

Psychotherapy

Stimulant medication alone is rarely enough to take care of the many therapeutic needs of ADHD children. Behavior therapy is often recommended to help a child increase self control and overcome problem behavior. Behavior therapy provides a supportive environment, direction and structure that help to decrease a child's anxiety.

Another approach deals with the ways adults react to the child's behavior. Good behavior is rewarded and difficult behavior results in undesirable consequences, a loss of rewards and time out.

Worth noting

A recent publication by the Center for Science in the Public Interest, Diet ADHD and Behavior quotes a 1995 study conducted by the National Toxicology Program that showed that Ritalin could produce liver tumors in mice. The report does not quote the fact that Ritalin did not produce tumors in other animals or that Ritalin and other stimulants used in ADHD treatment decreased the incidence of mammary tumors in rats, as published in Toxicology in 1995 and in Cancer Letters in 1996. The 1995 study reported in Toxicology states there have not been any epidemiological reports showing increased cancer risk in people on long term Ritalin treatment. Clearly, more studies are needed.

Summary

A large number of school children, boys more often than girls, have attention deficit hyperactivity disorder, also called ADHD. The syndrome is characterized by disruptive and impulsive behavior, difficulties in learning and low self esteem. The cause of ADHD is unknown, although genetic factors and environmental influences are thought to play a role in the disorder. While some investigators suggest that certain foods such as chocolate and milk or food additives are the cause of ADHD or influence hyperactivity, others do not find such a connection. The findings have been inconsistent and there is no agreement on the issue. Large definitive studies are needed to provide additional evidence.

Treatment is essential to reduce symptoms of hyperactivity and impulsiveness and to improve school performance and self esteem in children with ADHD. Use of stimulant medications such as Ritalin is usually continued as long as it provides benefit with minimal adverse effects. Dietary intervention via the elimination of certain foods may help in some cases. Behavioral therapy provided along with other treatments is useful. In fact, some studies suggest the entire family may benefit from psychotherapy as a means of coming to terms with the disorder, and thereby help the child improve and get on with home and school duties.

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