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ADHD and drug therapy: is it still a valid treatment?

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Abstract

The purpose of this article is to discuss alternative treatments other than drug therapy for Attention-Deficit/Hyperactive Disorder (ADHD) in educational settings. There is an increasing body of knowledge that supports interventions for improving cognitive outcomes without the use of medication. The article explores the risks to ADHD children, shows the potential linkage between gifted children and ADHD, explores recent brain research, and examines various alternative treatment options. Information is presented on alternative treatments such as cognitive behavioral therapies, educational interventions, electroencephalograph (EEG) neurofeedback, and diet.

Keywords alternative treatment • Attention-Deficit Hyperactive Disorder • brain research • interventions

Overview

Scientists and researchers estimate that Attention-Deficit Hyperactive Disorder (ADHD) affects between 3–5 percent of school-age children (Brown, 2000; Grantham, 1999; Kollins et al., 2001; Sales, 2000; Sterman, 2000) and up to 50 percent of clinic-referred children. ADHD is one of the most common reasons for referral in both school and community agencies. Of children referred to clinics for ADHD, 50 to 80 percent will continue to have symptoms of the disorder into adolescence (Brown, 2000; Sales, 2000).

When studied across time, children diagnosed with ADHD are at higher risk for learning, behavioral, and emotional problems throughout childhood and adolescence. Adults that are diagnosed with ADHD as children receive fewer years of formal schooling, achieve lower overall occupational status, and are more likely to have a range of psychiatric problems such as anti-social personali-

ty disorder or substance abuse. Furthermore, children with ADHD have difficulty with social interactions and family members, especially when co-occurring conditions are present (Kollins et al., 2001; Miranda and Presentacion, 2000).

Given the potential for adverse outcomes, effective treatment of ADHD is critical. Studies examining the efficacy of different kinds of interventions focus on three general approaches:

1 pharmacological (i.e. drug therapy);
2 behavioral/psychosocial; or
3 combinations of approaches.

Numerous scientific studies over the last decade have attempted to determine which approaches are most effective. Purdie et al. (2002) performed a meta-analysis of 74 studies within the last decade and found that the overall effect size for pharmacological interventions was higher than the other approaches for behavioral outcomes, but had little impact on educational outcomes. Thus, there is no consensus in the literature for an overall effective ADHD treatment, as each approach has weaknesses with respect to outcomes. However, educational treatments seem to result in better cognitive outcomes than medical or psychological approaches.

Statement of the problem

The widespread use of stimulant medication for treating ADHD has generated substantial controversy. In particular, critics have questioned the long-term safety and efficacy of chronic pharmaceutical use. For example, it is said that long-term use of medication during childhood increases the future risk for substance abuse by over 50 percent (Sales, 2000). The issue of whether the use of stimulants has significant long-term effects, whether positive or negative, is yet unresolved. In addition, there are others who doubt the existence of ADHD as a pathology altogether and eschew the labeling of children too early in development.

The purpose of this article is to present additional information on alternative interventions for treating ADHD in educational settings. Readers may draw their own conclusions as to the validity of drug therapy as a sole means of treatment, especially when applied to improve scholastic performance. This information is intended to support the treatment of ADHD without the use of medication. This article will review the risks to children that are diagnosed with ADHD, show the potential linkage between gifted children and ADHD, explore recent brain research, and examine some of the various alternative treatment options.

Risks for ADHD-affected children

Children with ADHD can be anxious, shy, socially withdrawn, moderately unpopular with classmates, poor at sports, and have poor school performance. Children diagnosed with ADHD are more likely to receive a co-diagnosis of an anxiety or affective disorder, and tend to be more anxious or avoidant of stressful situations. Teachers report that ADHD children are more distant (e.g. they have daydreams, fantasies), are more lethargic, and more impaired in perceptual-motor speed (Erk, 2000). Hynd et al. (1991) concluded that children with ADHD are more socially withdrawn, have a slower cognitive tempo, are more self-conscious, and have a higher incidence of developmental learning disorders. Other research suggested that children with ADHD have increased difficulties with development of mathematical abilities, they experience increased language delays (Erk, 2000), and have difficulties with reading (Pisecco et al., 2001).

Of the children that are diagnosed, 30–50 percent are also thought to have co-existing or associated psychiatric/behavioral disorders (Erk, 2000; Kendall et al., 1980; Sales, 2000). As many as 60 percent of children with ADHD will meet the criteria for oppositional-defiant disorder, and up to 50 percent will eventually meet the criteria for conduct or mood disorder (Brown, 2000). Depression, anxiety, and tics are also common (Kollins et al., 2001). The incidence of these co-existing disorders is more likely for children whose parents have a history of psychopathology or whose families are disorganized or dysfunctional. Children with Tourette's Syndrome, lead poisoning, fetal alcohol syndrome, retardation, early trauma, and seizure disorders frequently have ADHD (Sterman, 2000). Learning disabilities also occur frequently (Brown, 2000).

ADHD and gifted children

The symptoms that are generally attributed to ADHD are also highly characteristic of gifted children. Gifted children often exhibit over-excitability in psychomotor movement, imagination, emotion, and sensitivity. The restless energy of a gifted student could easily be mistaken for ADHD-hyperactivity type. The elaborate visualization, fantasy, or imaginative thinking in a gifted child's mind could be mistaken for ADHD-inattentive type. Gifted emotional expression and a sensitivity to touch, fabric, food, or odors could be misdiagnosed as the emotional over-reactivity that is associated with ADHD. The higher IQs of gifted children tend to intensify personality factors such as emotional responses, intellectual pursuits, rivalries, or struggles with authority. This intensity may manifest itself in heightened motor activity and the physical restlessness that is often mistaken as ADHD (Webb, 2000).

Whereas both gifted and ADHD children possess exceptional mental facul-

ties, ADHD children typically flounder due to a greater propensity toward disorganization and distractibility. Customarily, gifted children use resources better than their ADHD counterparts, yet many gifted children become easily bored with the traditional school curriculum. This may result in symptoms that appear to be like ADHD. Thus, educational professionals often have a difficult time telling the difference between children who *refuse* to do schoolwork, as opposed to those who *cannot* do the schoolwork (Flint, 2001).

Table 1 contrasts the similarities between the characteristics of gifted children and children with ADHD. Gifted children may exhibit impatience, boredom, and omit crucial details, whereas ADHD children may also miss important details due to their inattentiveness and forgetfulness. Gifted children may challenge others, question the status quo, or be rude, bossy, and domineering; yet ADHD children often become agitated, impatient, and interrupt or intrude on others inappropriately. The anxiousness of a gifted child could be mistaken for the restlessness of an ADHD child (Flint, 2001; Sales, 2000; Webb, 2000).

The similarities between giftedness and ADHD require thoughtful professional diagnosis before deciding on treatment. Flint (2001) asserted that ADHD symptoms require that educators and health professionals make a complete evaluation for both giftedness *and* ADHD. A gifted child should not be placed at risk for drug side-effects based upon an erroneous diagnosis, unless there are other conditions requiring medication.

Brain research on ADHD

Many causal factors have been implicated in the development of ADHD, including neurological, hereditary, natal factors, and toxic influence. Studies of identical twins found that 80 to 90 percent of ADHD in both twins could be explained by genetic factors, and that ADHD occurs five to seven times more frequently in the families of persons with the disorder (Grantham, 1999). Underactivity in areas of the brain that control inhibitory response suggest a neurological etiology.

Scientific data suggested that ADHD is due to neuro-anatomical or neurochemical abnormalities that result in the inconsistent meta-regulation of brain chemicals. Scientists now believe that ADHD is the result of chemical disruptions to the prefrontal cortex or regions of the brain that connect to it. A lack of proper chemicals affects the frontal lobes, such that they fail to inhibit emotional responses properly. This results in inappropriate cognitive or psychological responses, behavioral impulses, and reduced attention-monitoring processes. Many researchers believe that disinhibition is the core ADHD deficit of neurobiological brain functioning (Erk, 2000; Sterman, 2000).

More than 90 percent of children that are diagnosed with ADHD show electroencephalograph (EEG) regulation disturbances in the prefrontal and

Table 1: Characteristics of gifted versus ADHD children

Gifted	ADHD
Impatience, boredom, fantasy, rejects or omits details	Inattention, forgetful, fails to give close attention to details
Restless energy, heightened motor activity	Restlessness, hyperactivity
Extreme sensitivity to emotion, sound, touch, taste, smell, light, etc.	Emotional over-reactivity
Anxious, depressed	Restlessness, inattention
Challenges others, questions the status quo, bossy, rude, or domineering	Agitated, impatient, interrupts or intrudes on others
Asynchronous academic, social and intellectual development (situational)	Inconsistent developmental level (in all situations)
Intense concentration, persistence	Hyper-focus on specific areas
Tolerance for ambiguity and chaos, may appear scattered and disorganized	Disorganization and distractibility, low frustration tolerance

Source: Flint (2001); Sales (2000); Webb (2000)

sensorimotor cortex, with slowed or inhibited activity in all cortical areas. However, some of these disturbances are normal for children under the age of seven or eight. Therefore, children with irregular EEG patterns may be experiencing delayed maturation of the neural pathways (Sterman, 2000). Amen and Carmichael (1997) found that 65 percent of ADHD subjects showed a significant decrease in blood flow to the prefrontal cortex during concentration tasks. An additional 22 percent showed decreased blood flow during rest.

Using positron emission tomography (PET), Zemetkin et al. (1990) found that brain activity was significantly lower in adults with ADHD than in the control group. In ADHD brains, the slow metabolism of glucose was thought to contribute directly to ADHD behavior: the patterns that interfere with attention, self-regulation, cognitive performance, acquisition of social skills, and work-related activities. Lou et al. (1984) discovered differences in the metabolism of specific brain regions, such as the frontal lobes, that may explain why clients with ADHD have more trouble understanding, comprehending, or following instructions. This could imply that brains with ADHD have to work harder to get the benefit of sufficient metabolism or blood-flow when performing assigned tasks.

Denckla (1991) reported that magnetic resonance imaging (MRI) studies revealed evidence of immature or incomplete functions within the cerebellum for those diagnosed with ADHD. Also using MRI, Hynd et al. (1991) found that

the *corpus collusum* in children with ADHD was slightly smaller than the control group. This indicates that ADHD may be related to functional brain abnormalities. Other researchers found that total brain volume was approximately 5 percent smaller in boys with ADHD than in the control group, and that the right hemisphere volume was slightly, but significantly, smaller (Erk, 2000; Grantham, 1999).

Nonetheless, scientists have not discovered a unique brain pattern with ADHD. While ADHD brains are different, they also have many of the same developmental and neurological features as other types of brains. Normal variation of brain size and function occurs regularly in the population. In addition, brain research has been limited to a small percentage of the general population. Therefore, scientists cannot agree with certainty that ADHD children have a unique and identifiable brain blueprint.

Drug therapy

By far, doctors prescribe stimulants to treat ADHD more than any other class of drug. Common drug alternatives to stimulants include anti-depressants, selective serotonin-reuptake inhibitors (SSRIs), anti-hypertensive drugs, or anti-seizure medication (Brown, 2000). Although stimulant medication is quite effective for the majority of children with ADHD, up to 42 percent do not respond as intended (Barabasz and Barabasz, 2000; Brown, 2000; Sterman, 2000), and some show increased behavior problems.

The stimulants that are prescribed for ADHD exert their effects in the nervous system by altering the way in which the neurotransmitters function. While improving concentration and attention, stimulant drugs can sometimes result in unpleasant or unwanted side-effects. Brown (2000) claimed that the decision to prescribe stimulant medication is often made unsystematically through the subjective reports of parents. Kollins et al. (2001) stated that the appropriate clinical dosage for a child cannot be adequately established without detailed information from a variety of sources. Correct drug dosage is key to minimizing unwanted side-effects.

Table 2 summarizes the commonly prescribed ADHD drugs, their benefits, side-effects, and potential risks. The benefits obtained by drug therapy include many behavioral outcomes that are deemed important by adults, such as reduced aggression, improved social functioning, improved parent, teacher, and clinician ratings. However, the side-effects and risks of drug therapy are numerous and range from slight to fatal (in rare cases) (Barabasz and Barabasz, 2000; Brown, 2000; Grantham, 1999; Kollins et al., 2001). Knowledge about the long-term risks and benefits of using medications on young children is limited, and scientists do not yet understand the potential physiological side-effects of prolonged drug use on brain development (Sterman, 2000).

Table 2: Drugs used to treat ADHD

Drug	Benefits	Side-effects	Risks
Stimulants			
Methylphenidate (Ritalin) Mixed amphetamine salts (Adderall) Dextroamphetamine (Dexedrine) Pemoline (Cylert)	productivity and accuracy, improved behaviors, reduced aggression and anti-social behavior, improved social functioning and peer relations, improved parent and teacher behavior ratings	insomnia, decreased appetite, stomachache, headache, dizziness, sadness, unhappiness, crying, picking at the skin or fingers, irritability, anxiousness, and nightmares	tics, reduction in weight and growth, agitation, anxiousness, psychosis, Tourette's Syndrome, cognitive impairment, hypertension, hyperthyroidism, cardiovascular problems, glaucoma, fatal liver damage
Antidepressant drugs			
Tricyclic antidepressants (Imipramine, Tofranil) Selective serotonin-reuptake inhibitors: Fluoxetine (Prozac) Sertraline (Zoloft) Venlafaxine (Effexor) Other antidepressants (Wellbutrin)	improved clinician, parent, and teacher behavior ratings, alleviates depressive symptoms	constipation, drowsiness, increased blood pressure, blurred vision, dry mouth, hyperactivity, severe nausea, facial rash, and feeling 'spaced out'	cardiac toxicity, sudden death
Antihypertensive drugs			
Clonidine (Catapres) Guanfacine (Tenex)	improved clinician, parent, and teacher behavior ratings	sedation, irritability, headaches, and stomachaches	cardiac changes, drops in blood pressure and heart rate

Source: Barabasz and Barabasz (2000); Brown (2000); Grantham (1999); Kollins et al. (2001)

Use of medication alone tends to be palliative and provides only short-term benefits, such as increased attentiveness with decreased overactivity (Sterman, 2000). Thus, those who support multi-modal approaches assert that drug therapy does not really improve behavior without additional psychological, academic, and social interventions that are coupled with a stable support system (Flint, 2001; Kollins et al., 2001). Consequently, other forms of treatment are gaining popularity as parents and teachers begin to seek healthy alternatives for children.

Alternative treatments

Cognitive/behavior modification therapy

Studies have shown that initially, parents of children with ADHD rate behavioral intervention as more acceptable than medication (Kollins et al., 2001). Researchers have also agreed that counseling is necessary for treating co-existing disorders, particularly mood and anxiety disorders (Barabasz and Barabasz, 2000; Brown, 2000). Typical behavior modification therapies include: token economies, positive attention for appropriate behaviors, and withdrawal, extinction, or punishment for non-compliance. Other behavioral interventions used are: charting of antecedent behavior, reinforcement planning, and modeling behavior. The limitations of behavior therapy include the need for continued intervention, the complexity of the therapy, dependence on parent–teacher cooperation, and high cost (Barabasz and Barabasz, 2000; Grantham, 1999).

Kendall et al. (1980) developed a self-control program called 'Stop and Think'. This addressed hyperactivity and impulsivity by training children to improve their concentration and reflection skills. The Stop and Think technique employed problem-solving, self-instruction, modeling, role-playing, and reinforcement systems. Miranda and Presentacion (2000) combined Stop and Think with anger control procedures on ADHD children both with and without hyperactive-aggressiveness. Their anger control procedures consisted of identifying the physiological, cognitive, and affective cues of anger, coupled with relaxation techniques. The results of the combined therapy produced long-term positive effects on internalization problems and anti-social behavior. Improvements using the combined approach were better than the use of Stop and Think alone; however, their approach did not produce significant changes in either school performance or social adjustment.

Some researchers doubt the existence of ADHD as a pathology. Keirsey (1998) said that certain types of children possess a temperament that resembles ADHD, estimating that this personality comprises about 40 percent of the elementary school population. He maintained that it is much more likely that these children are not interested in their schoolwork. His corrective counseling technique, 'Abuse it– Lose it', prescribes systematic exclusion for students who habit-

ually disrupt classrooms (Keirsey, 2002a). The method is based upon the work of Alfred Adler, Erik Erickson, and, in particular, Rudolph Dreikurs, who developed the concept of logical consequences. Whereas arbitrary consequences lack a connection between the act and the punishment (i.e. they are convenient acts such as penalties or rewards), logical consequences invoke specific restrictions or feedback for inappropriate behavior.

Using Abuse it–Lose it, the logical consequence of bad behavior is the loss of privilege. In other words, the abuse of a privilege brings about a loss of that privilege. According to Keirsey (2002b), the lessons that a child remembers are highly dependent on whether he or she is treated as a person who needs medication, or as an active person who learns to control himself or herself. With logical consequences, the child learns control to keep privilege. However, Keirsey's critics say that the removal of disruptive children is, in many cases, exactly what the child wants.

Educational interventions

Levine (2003) also criticized those who classify ADHD as a disability and insisted that children learn in many ways. According to Levine, labeling children is destructive and misguided, and he eschews the practice of lumping children into broad categories, choosing instead to pinpoint specific learning problems. He argues that ADHD has become a catch-all for learning problems that stem from minor neurological malfunctions such as distraction, language processing, or information sorting. Levine stated: 'We believe that it ought to be possible to dissect, say, a child's attention issues without saying this is a pathology – to look at his neurocognitive profile without being judgmental' (quoted in Reunzel, 2001: 26).

Levine (2002) conducted evaluations of child learning called 'attuning', which involved parents, teachers, and children. Together, these evaluations created learning profiles of each student. Because medication is limited in influencing learning performance, Levine reasoned that teachers can clarify learning issues, thereby allowing students to become agents in their own education. Levine's theory of neurocognitive constructs groups the brain into functional areas correlated to specific learning tasks such as attention, memory, language, and neuromotor function. With this, Levine claimed that teachers could evaluate a student's neurological strengths and weaknesses. However, Levine's critics have suggested that his ideas are a warmed-over version of Gardner's multiple intelligence theory. Other school reformers have said that his attuning method is too extensive and complicated to translate into widespread school change (Reunzel, 2001).

EEG neurofeedback

Among the more promising alternative treatments, neurofeedback uses advanced electronics and computerized mathematical computations to convert EEG patterns into images and sounds on a video display. Based on the principle of operant conditioning, ADHD children learn to control and normalize the areas of the brain that are associated with inhibited EEG regulation. In this research, scientists fed external events such as lights, tones, or images to the individual as positives or negatives. A direct comparison of medication versus neurofeedback showed similar therapeutic results, as well as significant improvements in intellectual performance, without any negative side-effects (Sterman, 2000). In addition, studies showed that EEG neurofeedback resulted in significant and sustained physiological changes in both animals and humans, even during sleep (Barabasz and Barabasz, 2000).

A limitation of neurofeedback is that a large number of treatment sessions (80 sessions over six to eight months) are required to produce lasting effects. However, Barabasz and Barabasz (2000) found that adding hypnosis to EEG neurofeedback sessions accelerated response rates greatly, cutting the number of sessions required by about half. In a study of 19 ADHD subjects, all but four were able to eliminate their dependence on stimulants after 23 sessions (11 weeks), and the remaining four subjects were able to reduce their stimulant intake significantly. A criticism of neurofeedback is that there have not been enough subjects, that experiments are in clinical settings, and that there are a lack of robust controls (Sterman, 2000).

Diet

Zemetkin et al. (1990) found that global cerebral glucose metabolism was 8 percent lower in adults with hyperactivity than in normal controls, and confirmed a slower glucose metabolism in ADHD adults. Some professionals propose that the slow absorption of glucose contributes directly to ADHD behavior patterns (Grantham, 1999; Richardson, 2001). Webb (2000) found that about 3 percent of gifted children suffer from borderline hypoglycemic conditions and allergies. These conditions, when combined with intensity and sensitivity, result in behaviors that mimic ADHD. The ADHD-like symptoms vary depending on the time of day, length of time since the last meal, and the type of food eaten.

Research supported the theory that elements in food directly influence neurotransmitter production and metabolic processes. Researchers discovered that carbohydrates disrupt normal brain function in susceptible individuals and can create or aggravate learning disorders (Raby, 1995). If ADHD brains are slow to absorb glucose, it might suggest that individuals with ADHD might eat certain types of foods to change their neurochemistry. If the ADHD brain is slower to absorb glucose, it makes sense for the body to find a way to increase the supply of glucose to the brain as quickly as possible (Richardson, 2001). However, studies

on dietary treatment are very limited and remain inconclusive as a viable treatment for ADHD.

Discussion

Meta-analysis determined that educational interventions resulted in higher cognitive outcomes, while pharmacological interventions resulted in higher behavior outcomes (Purdie et al., 2002). ADHD requires a conclusive diagnosis due to the high incidence of co-existing disorders as well as a correspondence to gifted characteristics. The continuing focus on labeling for the purposes of categorization perpetuates ADHD as a pathology that requires 'treatment'. The solution begins when differences in children are viewed not as disorders, but as personal and unique characteristics.

Brain research suggested that while there are physiological and neurological differences in children who are affected by ADHD, they are not necessarily abnormal, but are a condition of normal variation. Researchers have only begun to explore how brain functions, temperament, and psychotherapy work together in order to improve learning. EEG neurofeedback suggested that many individuals could learn to control inappropriate impulses without drugs or extensive counseling.

Many researchers claimed that current science does not establish conclusively whether stimulant use increases the potential for abuse of other substances or has negative long-term effects. Thus, funding should be directed toward treatments that emphasize sustained improvement with more research in alternative therapies. Therapy should result in positive outcomes without potentially dangerous side-effects or risks. Health and education workers can begin to break the cycle of the drug culture by supporting drug-free research.

Not all children diagnosed with ADHD may need medication. The decision to use it depends greatly on the severity of symptoms, the coping abilities of the child, and the availability of other treatment interventions. Although medication seems effective in managing behavior problems, considerable improvements might be achieved also through properly implemented alternative interventions. Currently, parents, teachers, and doctors make decisions about drug therapy – being the same ones who appear to receive the greatest benefit from it. In the future, these decision-makers should consider selecting therapies less on the needs of adults and more on the long-term needs and benefits of children.

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