Evaluation and Treatment of ADHD

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Symptoms of attention-deficit/hyperactivity disorder (ADHD) are present in as many as 9 percent of school-age children. ADHD-specific questionnaires can help determine whether children meet diagnostic criteria for the disorder. The recommended evaluation also includes documenting the type and severity of ADHD symptoms, verifying the presence of normal vision and hearing, screening for comorbid psychologic conditions, reviewing the child’s developmental history and school performance, and applying objective measures of cognitive function. The stimulants methylphenidate and dextroamphetamine remain the pharmacologic agents of first choice for the management of ADHD. These agents are equally effective in improving the core symptoms of the disorder, but individual children may respond better to one stimulant medication than to another. Achievement of maximal benefit may require titration of the initial dosage and dosing before breakfast, before lunch and in the afternoon. The family physician should tailor the treatment plan to meet the unique needs of the child and family. Psychosocial, behavioral and educational strategies that enhance specific behaviors may improve educational and social functioning in the child with ADHD.

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Up to 19 percent of school-age children have behavioral problems, with up to one half of them displaying attention or hyperactivity problems.1 Frequently, family physicians are asked to evaluate and treat a child who does poorly in school, has disruptive relationships with peers or defies parental discipline. Although attention-deficit/hyperactivity disorder (ADHD) could account for such symptoms, physicians should remember that symptoms consistent with ADHD can be due to other disorders (Table 1).2-10 This article suggests a systematic approach to implementing key elements of the practice guidelines formulated by the American Academy of Pediatrics (AAP)11 and the American Academy of Child and Adolescent Psychiatry (AACAP)2 for the evaluation and treatment of children with presumed ADHD. Both guidelines recommend using ADHD-specific rating scales to obtain parent and teacher ratings of core symptoms, basing the diagnosis on the criteria for ADHD as given in the Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV),12 and screening for comorbid disorders. The AACAP proposes augmenting the standard history and physical examination with a review of the child’s developmental and family history, confirmation of normal hearing and vision in the child, and an assessment of family stressors and coping style (Table 2).2,11 A detailed evaluation can be a challenge for the family physician who first learns of a child’s difficulties during a routine office visit when parents are intent on obtaining stimulant medication for a child who has already been “diagnosed” with ADHD by themselves or teachers. This initial office visit may only allow time to listen to the parents’ concerns, explain the need for a thorough evaluation and arrange for further data collection. A systematic approach to diagnosis can help the physician avoid the tempting (and seemingly time-efficient) urge to forego a comprehensive evaluation, write a prescription and “monitor progress” at a subsequent visit.

Parents and teachers should understand that a careful and complete evaluation will span several office visits and may require special testing or consultation. Parents and teachers can better accept the postponement of immediate treatment if the physician communicates an understanding of the behaviors that concern them, indicates a shared commitment to doing what is best for the child and explains the elements of a stepwise, compre-
Confirming the Diagnosis

A number of questions need to be answered before the diagnosis of ADHD can be established.

Do the child’s symptoms fulfill DSM-IV criteria for the diagnosis of ADHD?

Despite broad endorsement for using ADHD-specific behavior rating scales and DSM-IV criteria to diagnose and monitor ADHD, most primary care physicians use neither.1 Yet proper diagnosis of ADHD requires a clear understanding of the type and severity of academic difficulties and the core ADHD behaviors that occur at home and in school.2,3,11

The DSM-IV criteria for the diagnosis of ADHD are given in Table 3.12 Examples of practical ADHD-specific rating scales that elicit DSM-IV criteria for inattention and hyperactivity are provided in Figure 1:13; norms for patient age and gender, and scoring information for physicians are provided in Figure 2.13 Children with scores above the 93rd percentile generally meet the DSM-IV criteria for the diagnosis of ADHD. Administration of the scales should be repeated periodically as part of an overall assessment of the child’s response to treatment.

Does the child have normal vision and hearing?

It is important to verify that the child’s vision and hearing are normal. Visual and auditory problems can contribute to poor school performance and inattention.

Does the child’s history suggest the presence of a comorbid psychiatric disorder?

Some of the behaviors in ADHD can be manifestations of, or coexist with, other psychiatric disorders. As many as one third of children with ADHD also have oppositional defiant disorder, one fourth to one half have conduct disorder, one fifth have depression and one fourth have anxiety.4,10,14,15 Preschool-age children and adolescents who have not been previously diagnosed with ADHD are more likely to have comorbid psychiatric conditions.5

The family physician can screen for comorbid psychiatric disorders using questions such as those given in Table 4. Positive responses should prompt more formal evaluation and consideration of the DSM-IV criteria for such disorders.12

**TABLE 1**

<table>
<thead>
<tr>
<th>Differential Diagnosis of ADHD</th>
<th>Neurologic conditions</th>
<th>Environmental conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>General medical conditions</td>
<td>Learning disability*</td>
<td>Improper learning enviroment (e.g., unsafe, disruptive)*</td>
</tr>
<tr>
<td>Hearing impairment</td>
<td>Tic disorder</td>
<td>Mismatch of school curriculum with child's ability (e.g., gifted, learning-disabled)</td>
</tr>
<tr>
<td>Visual impairment</td>
<td>Seizure disorder</td>
<td>Family dysfunction or stressful home environment*</td>
</tr>
<tr>
<td>Medication effects (e.g., antihistamine decongestants, beta agonists, anticonvulsants)</td>
<td>Mental retardation (e.g., fetal alcohol syndrome, fragile X syndrome, phenylketonuria)</td>
<td>Poor parenting (e.g., inappropriate, inconsistent, punitive)*</td>
</tr>
<tr>
<td>Asthma</td>
<td>Developmental delays</td>
<td>Child neglect or abuse*</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>Brain injury</td>
<td>Parental psychopathology*</td>
</tr>
<tr>
<td>Eczema</td>
<td>Sleep disorders</td>
<td></td>
</tr>
<tr>
<td>Enuresis*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encopresis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malnutrition (e.g., vitamin deficiency)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead toxicity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*— Common comorbid and associated conditions.

Information from references 2 through 10.
Does the child have a learning disability?

Although ADHD behaviors alone may result in poor school performance, it is important to remember that 20 to 30 percent of children with ADHD also have learning disabili-

Parents and teachers should understand that a careful and complete evaluation will span several office visits and may require special testing or consultation.

TABLE 2
## TABLE 3
### DSM-IV Criteria for the Diagnosis of ADHD

A. Either 1 or 2:

1. Six (or more) of the following symptoms of inattention have persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level:

   Inattention
   a. Often fails to give close attention to details or makes careless mistakes in schoolwork, work or other activities
   b. Often has difficulty sustaining attention in tasks or play activities
   c. Often does not seem to listen when spoken to directly
   d. Often does not follow through on instructions and fails to finish schoolwork, chores or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
   e. Often has difficulties organizing tasks and activities
   f. Often avoids, dislikes or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)
   g. Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books or tools)
   h. Is often easily distracted by extraneous stimuli
   i. Is often forgetful in daily activities

2. Six (or more) of the following symptoms of hyperactivity-impulsivity have persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level:

   Hyperactivity
   a. Often fidgets with hands or feet, or squirms in seat
   b. Often leaves seat in classroom or in other situations in which remaining seated is expected
   c. Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
   d. Often has difficulty playing or engaging in leisure activities quietly
   e. Is often “on the go” or acts as if “driven by a motor”
   f. Often talks excessively
   g. Often blurts out answers before questions have been completed
   h. Often has difficulty awaiting turn
   i. Often interrupts or intrudes on others (e.g., butts into conversations or games)

   Impulsivity
   g. Often blurts out answers before questions have been completed
   h. Often has difficulty awaiting turn
   i. Often interrupts or intrudes on others (e.g., butts into conversations or games)

B. Some hyperactive-impulsive or inattention symptoms that caused impairment were present before the age of seven years.

C. Some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home).

D. There must be clear evidence of clinically significant impairment in social, academic or occupational functioning.

E. The symptoms do not occur exclusively during the course of a pervasive developmental disorder, schizophrenia or other psychiatric disorder and are not better accounted for by another mental disorder (e.g., mood disorder, anxiety disorder, dissociative disorder or a personality disorder).

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DSM-IV = Diagnostic and Statistical Manual of Mental Disorders. 4th ed.; ADHD = attention-deficit/hyperactivity disorder.

ADHD Rating Scale-IV: Scoring and Norms

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FIGURE 2.
Cognitive testing may be beneficial in the child whose reading or language achievement is below grade level. This testing can be used not only to assess learning disabilities but also to identify academic strengths and suggest educational interventions to improve school performance. Some physicians choose to determine the need for formal cognitive testing after observing the impact of stimulant medication on a child’s ADHD symptoms and school performance.

Has the child’s development proceeded normally?

Although the parents of children with ADHD frequently describe colic, difficult temperament and feeding or sleep problems, developmental milestones are usually normal. A history of developmental delay suggests the possibility of an underlying organic condition.

How has the family responded to the child’s behavior?

Family dysfunction can cause behaviors consistent with those occurring in ADHD. Similarly, family tensions can exacerbate existing ADHD. Therefore, it is important to inquire about family stressors and coping methods. For instance, the family physician should understand the family’s philosophical approach to discipline, as well as their difficulties in disciplining the child with ADHD.

Do the findings of the child’s history or physical examination suggest the need for additional diagnostic testing?

ADHD is a clinical diagnosis. Blood tests and imaging studies of the brain are not recommended in the routine evaluation of the child with ADHD symptoms. Diagnostic testing should be guided by the findings of the history and physical examination.

A family history of mental retardation, fragile X syndrome, phenylketonuria or degenerative neurologic disorder suggests the need for further evaluation. Similarly, dysmorphic features and abnormalities of growth, development or neurologic function may reflect a genetic disorder (e.g., fragile X syndrome), a prenatal insult (e.g., alcohol abuse by the mother) or a chronic medical condition.

Creating an Individualized Treatment Plan

A comprehensive treatment plan should address not only the child’s symptoms of inattention, hyperactivity and impulsivity, but...
also the child’s academic performance, social interactions and family function. The AACAP recommends a multimodal treatment plan.2
One reason for this recommendation is that even though pharmacotherapy improves attention and decreases excessive physical activity, these symptomatic improvements do not necessarily enhance the child’s function in educational or social domains.3,19,20 Thus, it is reasonable to recommend parental support and education to improve coping abilities, suggest behavioral interventions to improve conduct at home and school, and advocate educational intervention to optimize academic progress.2,3,21

The Multimodal Treatment Study of Children with ADHD (MTA) was a well-designed randomized trial comparing four ways to treat ADHD: protocol-based medication management alone, intensive behavioral treatment alone, combined medication and behavioral (multimodal) treatment, or community care.22 In the community-care group, children with ADHD and their parents received information about their comprehensive assessments and the available mental health resources for ADHD in their community. In this group, the decision to use medications, behavioral interventions, or both, was left to the discretion of community-based physicians and the children’s parents. Two thirds of the children in the community-care group received stimulant medications.

The study showed that protocol-based medication management plus intensive behavioral therapy did not improve core ADHD symptoms better than protocol-based medication management alone, but that both strategies were superior to community care. Intensive behavioral treatment alone was nearly equal in effectiveness to community care, confirming the viability of specialized behavioral treatment for parents who prefer nonpharmacologic treatment of ADHD.23

Most family physicians cannot access the intensive behavioral treatment used in the MTA study. However, they can create multimodal treatment plans using elements of various psychosocial, behavioral and educational interventions.

PSYCHOSOCIAL INTERVENTIONS

Psychosocial interventions should help the child with ADHD gain social skills and have more satisfying interactions with peers and family members. For instance, encouraging children with ADHD to participate in sports or other recreational activities may promote self-esteem and improve positive relationships with peers and adults.

ADHD advocacy and support groups can help parents adapt to the challenges of living with a child who has ADHD. These groups can also help parents learn useful behavior management and discipline strategies.

Individualized counseling may benefit the child with ADHD who has a comorbid psychologic condition. This form of counseling can also be helpful if the family has been experiencing emotional distress.

BEHAVIORAL INTERVENTIONS

Behavioral interventions use positive rewards to encourage appropriate behaviors and reduce problem behaviors. These interventions begin with a detailed description of specific behaviors and the environmental conditions that elicit and reinforce them. Interventions are most effective when parents and school personnel focus on a limited number of
specific behaviors, agree to a system of rewards and consequences, and apply the consequences quickly and consistently in all settings.

EDUCATIONAL INTERVENTIONS

The purpose of educational interventions is to maximize the likelihood of the child's academic success by developing areas of strength, adapting to special needs and remediating knowledge and skill deficits. Schools have a legal responsibility to determine whether a child is eligible for special educational services, such as tutoring or adaptation of educational methods, and to ensure that these services are provided. Teachers may suggest academic skills training to help the child follow directions, use time efficiently, check his or her work, take notes and study effectively.

PHARMACOLOGIC TREATMENT

An evidence-based review by the Agency for Healthcare Research and Quality (formerly the Agency for Health Care Policy and Research) found that most studies of ADHD treatments were limited by one or more design deficiencies in sample size, descriptions of primary outcomes, measurement of compliance or assessment for comorbid disorders. Despite these limitations, the authors of the review concluded that ADHD symptoms tend to improve over time with or without treatment, that stimulant medications and desipramine improve core symptoms more effectively than placebo, and that currently available stimulants have equal efficacy.

Although stimulant medications improve core ADHD symptoms in up to 80 percent of properly diagnosed children, the diagnosis of ADHD cannot be reliably confirmed or excluded based on a positive or negative response to stimulants. Stimulant medications may improve excessive physical activity, inattention, impulsivity and poor self-control, physical and verbal aggression, and low academic productivity. Treatment with these agents may not improve antisocial behavior, reading skills or academic achievement.

Reported adverse effects of stimulant medications include insomnia, decreased appetite, stomach pain, headache, emergence or worsening of tics, decreased growth velocity, tachycardia, blood pressure elevation, rebound or deterioration of ADHD behaviors when medication wears off, emotional lability, irritability, social withdrawal and flattened affect. Because many of these signs and symptoms are reported in children with ADHD who receive a placebo, it is prudent to document the presence or absence of potential adverse effects before a stimulant drug is initiated.

Of the stimulant drugs used to treat ADHD, only pemoline (Cylert) is associated with an increased risk of liver damage and hepatic failure. Accordingly, the package insert warns that pemoline should not be prescribed without first obtaining informed consent using the form supplied by the manufacturer of the drug. The package insert also recommends monitoring serum alanine aminotransferase levels before pemoline therapy is initiated and every two weeks thereafter.

A number of stimulants, some with short- and long-acting formulations, are listed in Table 5. The table includes recommendations for initial and maximal dosages, some based on body weight. When reviewing these recommendations, the physician should remember that the response to stimulant medication is not directly related to the dose per kilogram of body weight or to serum drug levels.

Because the MTA medication management strategy produced results that were superior to those of community care, the family physician may wish to emulate this strategy for prescribing stimulants. The MTA protocol first identified the best dose of methylphenidate by measuring the effect of placebo and various

Combination (multimodal) treatment did not improve core ADHD symptoms better than protocol-based medication management alone, but both were superior to community care.
methylphenidate doses on the findings of ADHD rating scales completed by parents and teachers.22 Methylphenidate doses of 5, 10 and 15 or 20 mg were administered at breakfast and lunch, with one half of the dose (rounded to the nearest 5 mg) given in the afternoon. An inadequate response to methylphenidate was followed first by a trial of dextroamphetamine, then pemoline and then imipramine. Dosages were increased if the rating scales showed an incomplete response or were decreased to alleviate adverse effects.

**TABLE 5**

**Medications Used to Treat ADHD**

<table>
<thead>
<tr>
<th>Medication</th>
<th>How supplied</th>
<th>Usual initial dose</th>
<th>Single-dose range</th>
<th>Dosage range</th>
<th>Dosage schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylphenidate, immediate release</td>
<td>Tablet: 5, 10 and 20 mg</td>
<td>0.3 to 0.6 mg per kg per dose, or 2.5 to 5 mg</td>
<td>0.3 to 0.8 mg per kg</td>
<td>5 to 80 mg per day</td>
<td>Two or three times daily: full dose given 30 minutes before breakfast and lunch; half-dose given at 3:00 to 4:00 p.m.</td>
</tr>
<tr>
<td>Ritalin-SR</td>
<td>Tablet: 20 mg</td>
<td>20 mg</td>
<td>0.6 to 2 mg per kg, or 20 to 40 mg</td>
<td>20 to 80 mg per day</td>
<td>Once or twice daily</td>
</tr>
<tr>
<td>Concerta</td>
<td>Tablet: 18 and 36 mg</td>
<td>18 mg</td>
<td>18 mg</td>
<td>18 to 54 mg per day</td>
<td>Once daily</td>
</tr>
<tr>
<td>Methylin</td>
<td>Tablet: 20 mg</td>
<td>20 mg</td>
<td>0.6 to 2 mg per kg, or 20 to 40 mg</td>
<td>20 to 80 mg per day</td>
<td>Once or twice daily</td>
</tr>
<tr>
<td>Dextroamphetamine, extended release</td>
<td>Tablet: 5 and 10 mg</td>
<td>2.5 to 5 mg</td>
<td>5 to 40 mg</td>
<td>Two or three times daily: full dose given 30 minutes before breakfast and lunch; half-dose given at 3:00 to 4:00 p.m.</td>
<td></td>
</tr>
<tr>
<td>DextroStat</td>
<td>Tablet: 5 and 10 mg</td>
<td>2.5 to 5 mg</td>
<td>5 to 40 mg</td>
<td>Two or three times daily: full dose given 30 minutes before breakfast and lunch; half-dose given at 3:00 to 4:00 p.m.</td>
<td></td>
</tr>
<tr>
<td>Dextroamphetamine, extended release</td>
<td>Tablet: 5, 10 and 15 mg</td>
<td>5 mg each morning</td>
<td>0.3 to 0.8 mg per kg, or 5 to 20 mg</td>
<td>5 to 40 mg per day</td>
<td>Once or twice daily</td>
</tr>
<tr>
<td>Amphetamine-dextroamphetamine (Adderall)</td>
<td>Tablet: 5, 10, 20 and 30 mg</td>
<td>2.5 to 5 mg</td>
<td>0.15 to 0.5 mg per kg</td>
<td>2.5 to 40 mg per day</td>
<td>Once or twice daily</td>
</tr>
<tr>
<td>Pemoline (Cylert)</td>
<td>Tablet: 18.75, 37.5 and 75 mg Chewable tablet: 37.5 mg</td>
<td>18.75 mg each morning</td>
<td>0.5 to 2.5 mg per kg</td>
<td>2 mg per kg, or 18.75 to 112.5 mg per day</td>
<td>Once or twice daily</td>
</tr>
</tbody>
</table>

ADHD = attention-deficit/hyperactivity disorder; NA = not available.

Information from references 4, 9, and 19 through 22.
In some children, stimulant medications with longer half-lives may be beneficial if the effects of short-acting preparations are too brief (two and one-half to three hours), if symptoms worsen at the end of the dosing interval or if administering medication at school is problematic. A combination agent containing amphetamine and dextroamphetamine (Adderall) has a rapid onset and longer duration of action than methylphenidate; in appropriate dosages, it may prevent rebound symptoms.\textsuperscript{25} However, no study has shown
that this agent is superior to the dextroamphetamine stimulants.

Because of lack of efficacy or the emergence of adverse effects, stimulant therapy is unsuccessful in 25 to 30 percent of children. A child may respond poorly to stimulant medication because of an undiagnosed comorbid condition, the emergence of psychosocial stressors or noncompliance. In the MTA study, children were given bupropion or haloperidol if stimulants proved ineffective. Desipramine and clonidine have also been suggested as alternatives to stimulants in children with ADHD.

ALTERNATIVES TO DRUG THERAPY FOR ADHD

Parents of children with ADHD may inquire about alternatives to drug treatment, including dietary modification, nutritional supplements, homeopathy and vision therapy. The family physician should be familiar with the studies that have evaluated the efficacy of these treatments.

The most widely studied dietary modifications for the treatment of ADHD are the additive-free Kaiser-Permanente diet and the Feingold diet. These diets have been found to produce behavioral or cognitive improvement in approximately 5 percent of hyperactive children. Unfortunately, this response rate is no better than the expected response to placebo.

Parents of a child with ADHD who wish to pursue dietary modification should do so in consultation with a physician to monitor progress and in consultation with a dietitian to ensure nutritional adequacy. They should also recognize the potential risk of forgoing pharmacologic treatment, which has many benefits.

Reducing or eliminating sugar to treat ADHD has widespread support among lay persons and in the lay press. However, controlled trials have not shown that the ingestion of sugar has an effect on activity or aggression in normal or hyperactive children.

ADHD symptoms are not improved by supplementing a child’s diet with iron, magnesium, pyridoxine or zinc if no nutritional deficiency exists. Similarly, megavitamin therapy does not improve ADHD behaviors and may produce toxic effects. Eye muscle exercises and special eyeglass lenses have not proved beneficial in children with ADHD.

INDICATIONS FOR REFERRAL

Further assessment by a psychiatrist or developmental-behavioral pediatrician may be beneficial for children with ADHD who have comorbid psychiatric conditions, who do not respond to stimulants or who have extremely difficult problems in their relationships with peers, teachers or family. Referral is also indicated for children with developmental abnormalities or mental retardation and severe symptoms of ADHD.

Follow-up Visits

Follow-up visits should occur as often as needed to monitor the effects of a comprehensive treatment plan. The MTA study, which showed that combined medication and behavioral treatment was superior to standard community care, used monthly 30-minute medication management visits to encourage and advise children and parents, review ADHD rating scales and adjust medication dosages.

Because the child with ADHD frequently has low self-esteem and few successes, the family physician should start each visit by having the child and parent report positive experiences with hobbies, athletics, peer activities, family interactions or academic performance. Then the physician should monitor the effects of medications by reviewing ADHD-specific rating scales and inquiring about possible adverse drug effects.
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