Chapter 2
Medical Evaluation for ADHD Symptoms in Adolescents

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Case Example

Britney is a 15-year-old, healthy girl, who starts struggling in 9th grade classes. She has been without any learning, developmental, or medical concerns until now. She tells her parents that she cannot pay attention in class and that she cannot follow what is being taught. She was a solid, hardworking student prior to this year. Parents scheduled a pediatric visit to figure out what's going on with her.

Background

This book has contributions from developmental behavioral pediatricians, pediatric psychologists, a psychiatric nurse practitioner, a social worker, and general pediatricians. While we present evidence-based practices, your clinician may view the same evidence from a different perspective. Chapter 1 focused on making the diagnosis: anyone making the diagnosis should complete a detailed history, review current and historical functioning in the home and community settings (which often requires attention rating scales completed by teachers or others), as well as review the diagnostic criteria in the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* (DSM-5) [1]. Here we review the medical evaluation appropriate when a patient presents with the question of ADHD.

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The Medical Evaluation and the Medical Evaluator

How do the fields differ in providing ADHD care? It's not entirely clear. National societies of pediatrics and psychiatry have has its own ADHD diagnosis and treatment guideline for its field [2, 3]. These guidelines are certainly more similar than different. Published research studies describe different patterns for prescribing ADHD medication across the disciplines, but not for diagnosing ADHD [4]. In our experience, practice patterns differ not only among clinicians but also within a discipline: some pediatricians are more comfortable diagnosing older or younger children than others. Some psychiatrists provide therapy along with medication, and some neurologists look harder for medical disorders before diagnosing and treating. More evident differences come when looking at regional patterns, reflecting access to specialists, educational services, and cultural preferences. Information in this book generally adheres to the AAP guidelines.

Across specialties, clinicians recognize that other conditions, mostly other emotional, behavioral, or neurodevelopmental disorders, as well as response to environmental stress, may mimic ADHD or co-occur with ADHD (Table 2.1). Chapters later in this book go into more detail about the specifics of each "mimicker."

The remainder of this chapter will review when additional medical evaluation may be necessary to differentiate the diagnosis of ADHD from other physical or medical conditions mirroring ADHD symptoms or co-occurring with ADHD symptoms. Physical or medical conditions that may mirror or co-occur with ADHD are listed in Table 2.2 [1, 5–10].

> Your clinician may recommend a different evaluation from what you see below. Ask why! There may be a very good reason, and you are sure to have an informative discussion.

Table 2.1 Disorders and contexts that create symptoms similar to ADHD

ADHD mimickers [1, 5–8]		
Emotional/behavioral disorders [1, 6, 7]	Psychosocial factors [6–9]	Neurodevelopmental disorders [1, 5–7, 9, 10]
Anxiety	Socioeconomic stressors	Learning disorders
Depression	Maltreatment/abuse	Intellectual disability
Oppositional defiant disorder/ conduct disorder	Bullying	Autism spectrum disorder
Mood disorders	Conflicts between child and parents, other family members, friends, or teachers	Speech and language disorders
Obsessive-compulsive disorder		Tic disorders
Post-traumatic stress disorder	Unsuccessful parenting or classroom management techniques	Stereotyped movement disorder
Adjustment disorders		

Table 2.2 Physical and medical conditions mimicking/co-occurring with ADHD

Hearing impairment	Fetal alcohol syndrome
Visual impairment	Brain injury
Seizure disorders	Genetic disorders (such as 22q11 deletion syndrome, neurofibromatosis, or fragile x syndrome)
Disordered sleep	
Narcolepsy	
Substance use	Metabolic disorders (such as phenylketonuria)
Thyroid disorders	Complications of central nervous system infection
Lead toxicity	Medication side effects (such as bronchodilators, thyroid replacement medications, corticosteroids, or neuroleptics)
Malnutrition	

History and Physical Examination

The medical evaluation begins within a comprehensive history as well as physical examination. The history should include a timeline of the presenting symptoms, current functioning across settings, educational history, birth history, developmental history, medical history, mental health history, and family and social histories [3, 10]. During a portion of the history, the adolescent should be interviewed alone, as they may not be comfortable discussing certain topics in front of parents or caregivers, including mistreatment, anxiety or depressive symptoms, substance use, and sexuality [3].

The physical examination should include a neurologic examination (checking that the nerves are working, from the eyes to the ankles), as well as hearing and vision screenings [6, 7]. Psychologists and social workers do not complete physical examinations and may defer to the primary care provider. Hearing and vision screen may be completed in a primary care office or referred elsewhere. Administration of a mental status examination can be helpful to elicit behavioral or emotional disorders [3]. A mental status examination assesses appearance, behavior, speech, mood, affect, thought process, thought content, cognition, insight, and judgment.

Neuroimaging Studies

Neurological studies and neuroimaging studies are not indicated in the medical workup of ADHD, unless concerns are elicited from the history and physical for another condition or disorder that presents with symptoms that overlap with ADHD and is diagnosed with imaging. In general, as there is no biological marker of ADHD, neurological and neuroimaging studies are nondiagnostic, and they cannot predict treatment response in ADHD [3, 12]. Furthermore, using neuroimaging studies that involve exposure to radioactivity or intravenous radioactive nucleotides

to assess for ADHD is not recommended, given both safety concerns and a lack of evidence showing utility of the studies [3]. Neurological studies and neuroimaging studies used to research (not diagnose, just research) ADHD include magnetic resonance imaging (MRI), functional MRI (fMRI), single photon emission computed tomography (SPECT), positron emission tomography (PET), electroencephalogram (EEG), event-related potential (ERP), and computed tomography (CT or CAT) scan. Some studies have shown that as a population, children with ADHD have slow wave changes on their EEG, reduced brain volume, and possibly a delay in maturation of their brain, but these findings are nondiagnostic, and there can be overlap with other neurological or psychiatric disorders [1, 12]. Having one of these findings does not equate to a diagnosis of ADHD, nor does it explain how ADHD developed. Absence of one of these findings does not mean ADHD is an inaccurate diagnosis. Research shows there is much overlap between findings in brain structure and function between those with ADHD and those in the general population without ADHD [9].

While ADHD research using these modalities has helped the medical field learn more about the disorder, including brain pathophysiology, these findings are not helpful in making the initial diagnosis of ADHD.

Seizures

Seizures in children and adolescents may present with primarily inattentive moments [7]. Staring may be a common symptom seen in both seizures and ADHD, and it is important to elicit information about staring; is it interrupted with physical contact? How often does the staring occur? Does it occur in a variety of settings [11]? Absence seizures present as moments of blank staring with cessation of talking, any time of day and in all contexts. Lasting 10–20 seconds, absence seizures may appear as a lapse of attention, accompanied by eye fluttering, chewing, or other motor movements. During the absence seizure, the staring behavior cannot be interrupted. Subsequently, the child does not recall being unavailable but resumes their baseline level of alertness. While children with ADHD may commonly stare, staring episodes can be interrupted, particularly with touch. One study comparing patients with ADHD to those with absence seizures found that inattention, unfinished homework, and reduced task persistence were seen significantly more in ADHD than in those with absence seizures. In contrast, these behaviors were found to occur in low frequency in those with absence seizures [11]. Neither EEG nor referral to a neurologist is routinely required for medical diagnosis of ADHD, unless history or physical examination is concerning for a seizure disorder or other unusual neurologic findings.

Sleep

The relationship between sleep, symptoms of inattention, and the diagnosis of ADHD is complex. Many sleep disorders, insufficient sleep, and snoring can significantly affect attention and may present with symptoms of inattention [7, 13]. Sleep disorders to consider include sleep apnea, narcolepsy, and periodic leg movements. Prior to making the diagnosis of ADHD, sleep disorders should be ruled out as a solitary cause of ADHD-like symptoms. A comprehensive sleep history should be obtained during the medical history component of an ADHD evaluation. Information about the number of hours of sleep, number and duration of nighttime awakenings, snoring, symptoms of apnea, movements during sleep, and daytime sleepiness should be obtained. In addition to sleep problems leading to symptoms that may mimic ADHD, those with ADHD can have comorbid sleep problems exacerbating symptoms of ADHD [13, 14]. If the medical history is suggestive of a sleep disorder, subjective and objective measures are needed to better assess for a sleep disorder [13]. Subjective measures might include self-completed or parent-completed sleep diary. Objective measures are polysomnography (sleep study), actigraphy (movement monitor), multiple sleep latency test, or serum ferritin levels [13, 14].

Hearing and Vision

Hearing and vision screenings should be part of the physical examination when considering ADHD. Each can present with symptoms of apparent inattention as well. If screenings performed or the elicited history are concerning for hearing loss and/or vision impairment, referral for audiologic evaluation or ophthalmologic evaluation should be made.

> Vision and hearing deficits are both common and can first develop or be recognized in teens.

Thyroid Disorders

Thyroid disease, including both hypothyroidism and hyperthyroidism, can present in adolescence and can lead to ADHD-like symptoms of inattention or hyperactivity, respectively [7]. Typically, with hypothyroidism or hyperthyroidism, there are additional associated signs and symptoms that help to differentiate them from a diagnosis of ADHD. These signs and symptoms may include agitation or irritability, emotional instability, decreased energy, impaired memory, goiter, or decreased growth velocity [3, 15, 16].

Routine screening for thyroid function tests is not recommended in the ADHD evaluation. In previous studies of children referred for an ADHD evaluation without other associated symptoms of thyroid dysfunction, thyroid function studies were normal [3, 15, 16].

Toxins

Children and adolescents exposed to toxins may present with symptoms of ADHD. Toxin exposure can occur prenatally or during childhood and adolescence. Toxins that are known to present with attentional symptoms include alcohol, lead, specific prescribed medication, and illicit substances [7]. Fetal alcohol syndrome often presents with symptoms of ADHD. Children with fetal alcohol syndrome have a higher incidence of ADHD compared to the general population [3]. The diagnosis of fetal alcohol syndrome is a clinical one that can be determined by history and physical examination findings; no medical testing is necessary to establish the diagnosis.

Lead exposure both prenatally and during childhood and adolescence is associated with an increased risk of ADHD. If the adolescent being evaluated has possible exposure to lead in their environment, such as living in an older home or in a home with old plumbing, performance of a serum lead level should be considered [3]. In general, lead exposure at any point presents with a number of impairments other than ADHD, and unless other symptoms are elicited during the evaluation of ADHD (headaches, belly pain, joint and muscle pain, memory difficulty), screening of serum lead levels should not be part of the medical evaluation for ADHD [3, 17].

Medications that can induce ADHD-like symptoms include bronchodilators (such as albuterol), corticosteroids, isoniazid, neuroleptics, and replacement thyroid hormones [1, 5]. The patient's medical history should include a medication reconciliation to reveal any medications potentially contributing to the symptoms. Finally, use of illicit substances may present with ADHD-like symptoms. In adolescents, substance use may present with symptoms of declining school performance, inattention, or distractibility [5, 7]. Substance use should be reviewed during a comprehensive history; as discussed above, an adolescent is more likely to disclose substance use when interviewed separately from the family. Treatment of substance use disorders should occur before a new diagnosis of ADHD is made, to determine what symptoms are present in the absence of illicit substances [5].

Genetic and Metabolic Disorders

Many genetic and metabolic disorders present with symptoms of ADHD [7]. However, additional symptoms are present as well. Examples are neurofibromatosis, fragile X syndrome, 22q11 deletion syndrome, and phenylketonuria [5–7, 9]. History and physical examination are the first step in the medical evaluation of a possible metabolic or genetic condition. Details suggesting genetic disorder include

early and ongoing developmental or cognitive delays, involvement of other systems in the body, and specific facial features. Metabolic disorders are suggested by periods of developmental regression, failure to thrive, unusual odors, and difficulty tolerating otherwise minor illnesses. In the event that the medical history is suggestive, genetic or metabolic testing can be considered. While an underlying genetic disorder might account for the ADHD symptoms, remember that a comorbid diagnosis of ADHD can still be made if symptoms are present, are impairing, and are not commensurate with the patient's developmental level [1].

Nutritional Deficiency

Some research has suggested that iron deficiency and/or low ferritin levels may lead to symptoms of ADHD [18]. If the patient's history reveals selective eating or possible malnutrition, or if the physical examination is concerning for iron deficiency or anemia (pale, fast heart rate), laboratory work looking for iron deficiency or low ferritin levels may be considered. However, additional research is needed to fully understand the association between iron deficiency and ADHD [18].

Case Revisited

Britney's primary care provider completes a comprehensive history. She finds that Britney has indeed been healthy without exposure to toxins, medications, and trauma. She has no signs or symptoms of depression or anxiety, has an active social life, and looks forward to getting her driver's license next year. She sleeps well, 7 hours/night during the week and 12 hours at a stretch on weekends. Britney sees the blackboard well from the back of the class and is not aware of hearing issues; she passes office screening. She understands the academic material but loses track of what the class is doing. Her mother has seen Britney stop mid-sentence and stare off, unresponsive when her mother says her name or touches her arm. Her physical exam is entirely normal.

Britney undergoes an EEG for the specific concerns of absence seizures and then has a follow-up neurology visit to interpret and manage the abnormal findings of her EEG. Once she is treated for her absence seizures, Britney resumes her solid school performance. No ADHD diagnosis is warranted.

Conclusions

The medical evaluation for ADHD symptoms in adolescents warrants consideration of a vast differential diagnosis, explored through comprehensive history and physical examination. In order to diagnose ADHD, a history of symptoms should be

present prior to the age of 12; new onset of ADHD symptoms in adolescence should be considered carefully. The importance of a comprehensive history and physical cannot be overstated. ADHD is a clinical diagnosis; laboratory, neurological, or neuroimaging tests are typically not indicated, unless concerning findings are elicited on history or physical.

Tips

- Different clinicians might have different approaches to the evaluation of ADHD.
- The diagnosis of ADHD in teens requires a lengthy conversation to review the history and ongoing symptoms, including a private and confidential conversation between the patient and clinician (no parents present). Plan the time accordingly!
- Most adolescents diagnosed with ADHD don't require medical testing with blood tests, CT scans, or MRIs.

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