

An update on attention deficit hyperactivity disorder

Patients can be readily screened for symptoms of ADHD during a GP consultation. Before referring a patient, the GP should check hearing, vision and growth, and also facilitate a family discussion with the school.

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Our understanding of attention deficit hyperactivity disorder (ADHD) has changed from one of a problem affecting mostly children of primary school and early high school age to one of a life-long problem that manifests itself in different ways at different stages of development. The current diagnostic criteria for the condition, formulated by a working party of the American Psychiatric Association (see the box on page 18),¹ reflect a bias towards the way a person may present with

ADHD during middle aged childhood, but this will change when revised criteria are released in 2012. Emphasis will shift from hyperactivity to the enduring neurocognitive impairments thought to underpin a range of maladaptive behaviours and cognitive processes.

People of all ages with ADHD seem less inclined than others to think beyond the present and to learn from experience. It is thought that they have deficits in the ability to learn when, or in

IN SUMMARY

- ADHD can affect a child's behaviour, thinking and learning and the effects can continue into adulthood.
- People of all ages with ADHD seem less inclined than others to think beyond the present and to learn from experiences.
- Other developmental conditions can resemble and co-occur with ADHD, particularly learning difficulties, anxiety, agitated depression, conduct problems and frenzied stereotyped behaviours associated with autism.
- Medical problems, such as sequelae to brain injury or infection, some genetic disorders and fetal alcohol syndrome, can present with symptoms of ADHD. Other medical problems that may on rare occasions masquerade as ADHD include hyperthyroidism and lead toxicity.
- For ADHD to be clinically significant, symptoms should have been present since preschool or the early school years and be causing problems in two or more settings (e.g. school and home).
- The child's difficulties need to be considered within the family context.
- Before specialist referral of the patient, the GP should check hearing, vision and growth, and also facilitate a family discussion with the child's school.

which context, to expect an event that requires a person to mobilise control systems to bring about the necessary adjustments in behaviour, thinking and learning.² As a consequence, people with ADHD typically do the wrong thing, in the wrong place, at the wrong time. Interestingly, the control systems are present, but the problem is that they are not brought 'on-line' when needed.

Let's consider an example. Mr Weasley runs a successful laissez-faire year five classroom. Boisterousness is tolerated, within limits. His pupils revel in the opportunity to express themselves. Ms Grainger, the principal, is more 'old school' and prefers a restrained learning environment. On Friday afternoon the class is engaged in some small group work involving role play. Ms Grainger can be heard approaching. Mr Weasley's demeanour abruptly changes and the class responds by becoming hushed and earnest in their work. All that is, except for a boy with ADHD who, as the principal enters the room, continues to deliver a loud and heavily embellished impersonation of Ms Grainger.

Brain and the environment

The ability to form predictions about future outcomes and to optimise behaviour is mediated by the neurotransmitter dopamine, and irregularities in dopamine transmission seem to be central to the deficits seen in ADHD. Functional imaging of people with ADHD has shown hypoactivation of the prefrontal cortex, caudate nucleus, cerebellum and parietal cortex, compared with controls.

The cerebellum and caudate nucleus are involved in learning about the frequency and timing of events, whereas the parietal cortex is involved in signalling the prefrontal cortex to bias attention to one or other stimuli. The prefrontal cortex is involved in the regulation of behaviour. Hypoactivation of these brain regions in people with ADHD normalises in response to dopaminergic drugs.¹ Such abnormalities are present in individuals with ADHD from early in their development, suggesting genetic or early environmental influences.

Twin and adoption studies indicate a heritability factor for ADHD of between 60 and 90%.² Candidate genes include the dopamine transporter gene and the dopamine receptor type 4 gene.²

An update on ADHD



ADHD can affect a child's behaviour, thinking and learning and this can continue into adulthood. People of all ages with ADHD seem less inclined than others to think beyond the present and to learn from experiences. GPs need some knowledge of this condition and its management to educate patients and their families, co-ordinate initial management and expedite specialist referral of the patient.

Early environmental factors that could interact with genotypes to precipitate the onset of ADHD include perinatal stress, low birthweight, maternal smoking during pregnancy (more than 10 cigarettes per day), traumatic brain injury and severe early emotional deprivation.³ There is no evidence that ADHD is caused by ordinary variations in child-rearing practice.³

The diagnostic and statistical manual (DSM-IV) criteria for ADHD¹

Criterion A

A. Six or more of the following symptoms of inattention have been present for at least six months to a point that is disruptive and inappropriate for developmental level:

Inattention

1. Often does not give close attention to details or makes careless mistakes in schoolwork, work or other activities
2. Often has trouble keeping attention on tasks or play activities
3. Often does not seem to listen when spoken to directly
4. Often does not follow instructions and fails to finish schoolwork, chores or duties in the workplace (not due to oppositional behaviour or failure to understand instructions)
5. Often has trouble organising activities
6. Often avoids, dislikes or doesn't want to do things that take a lot of mental effort for a long period of time (such as schoolwork or homework)
7. Often loses things needed for tasks and activities (e.g. toys, school assignments, pencils, books or tools)
8. Is often easily distracted
9. Is often forgetful in daily activities

Criterion B

B. Six or more of the following symptoms of hyperactivity/impulsivity have been present for at least six months to an extent that is disruptive and inappropriate for developmental level:

Hyperactivity

1. Often fidgets with hands or feet or squirms in seat
2. Often gets up from seat when remaining in seat is expected
3. Often runs about or climbs when and where it is not appropriate (adolescents or adults may feel very restless)
4. Often has trouble playing or enjoying leisure activities quietly
5. Is often 'on the go' or acts as if 'driven by a motor'
6. Often talks excessively

Impulsivity

1. Often blurts out answers before questions have been finished
2. Often has trouble waiting one's turn
3. Often interrupts or intrudes on others (e.g. butts into conversations or games)

Types of ADHD identified

Based on these criteria, three types of ADHD are identified:

- ADHD, combined type: if both criteria A and B are met for the past six months
- ADHD, predominantly inattentive type: if criterion A is met but criterion B is not met for the past six months
- ADHD, predominantly hyperactive/impulsive type: if criterion B is met but criterion A is not met for the past six months

Prevalence and natural history

The prevalence of ADHD among children and adolescents in Oceania, Asia, Europe and North America is about 5%, with estimates being somewhat lower in the Middle East and higher in Africa and South America.⁴ Although the recognition of the disorder has clearly increased in the past 20 to 30 years, there is no convincing evidence of a growth in the community prevalence of ADHD.

A UK study found remarkably stable rates of hyperactivity among young teenagers in the community across surveys conducted in 1974, 1986 and 1999.⁵ Recognition rates are unusually high in some parts of the US,⁶ raising the possibility of false-positive diagnoses. Such aberrations influence public perception of the legitimacy of the diagnosis, but it is unlikely that ADHD is systematically overdiagnosed.⁷

Epidemiological studies show that only about 15% of children and adolescents with ADHD receive treatment,⁶ although studies using other methodologies find that the rate of prescribing matches or even exceeds the prevalence of the disorder.⁶ Why this contradiction exists is not understood. By middle adulthood, few individuals who were diagnosed during childhood will continue to meet the full diagnostic criteria for ADHD, but about a half will continue to experience some impairment arising from the neurocognitive deficits described above.⁸ Adults with residual ADHD symptoms are prone to occupational and relationship difficulties, driving offences, car accidents, emotional problems and problems associated with substance abuse.⁸

Comorbidity and differential diagnoses

Differential diagnoses of ADHD include learning difficulties, anxiety, agitated depression, conduct problems and frenzied stereotyped behaviours associated with autism. To confound matters,

ADHD may also co-occur with any of these disorders. Clues that the problem is primarily a learning difficulty (typically in reading and language) include a poor academic output and the child's behaviour and functioning being much better during tasks for which he or she has competence compared with tasks that expose his or her vulnerability.

Although ADHD is usually evident by the first or second year at school, anxiety can commence at any age. Problems with attention and impulse control are most apparent in children who are anxious when they are under stress, whereas in children with ADHD the problems are pervasive. I have noticed that children who are anxious tend to be emotionally and behaviourally dysregulated during the first few minutes of a consultation, after which they settle. In contrast, children with ADHD are well controlled early but may become disruptive during a long appointment.

Agitated depression is more likely to occur in older children who do not have a developmental history consistent with ADHD. Patients with adolescent-onset conduct problems are often described as being impulsive or inattentive, but again may not have a developmental history consistent with ADHD. This contrasts with children who have had both ADHD and oppositional behaviours from early childhood.

Oppositional defiant disorder (ODD) is seen in about 60% of patients who present to clinics with ADHD⁹ and is characterised by age-inappropriate tantrums, noncompliance, defiance, annoying or taunting behaviours, an unwillingness to accept blame, and an aggressive demeanour. Data are contradictory over whether ADHD and ODD are truly separate conditions.^{10,11} Individuals with ADHD symptoms with or without comorbid ODD respond similarly to stimulant and other medications. Comorbid ODD is associated, however, with poorer long-term outcomes.¹²

Some medical problems, such as sequelae to brain injury or infection, some genetic disorders and fetal alcohol syndrome, can present with symptoms of ADHD. Other problems can masquerade as ADHD, for example, hyperthyroidism and lead toxicity, but this is rare.

Assessment

In most circumstances GPs will be asked a direct question by parents, or by teachers relayed through parents, about the possibility of ADHD and the need for specialist referral of the individual. Many scales and questionnaires have been developed for the assessment of ADHD.³

In the GP surgery, symptoms may be surveyed by asking about the presence of each of the symptoms listed in the box on page 18.¹ The following scores should be used for symptoms: 0 = absent, 1 = mild/infrequent, 2 = moderate/frequent and 3 = severe/persistent. Only symptoms with scores of 2 or above should be considered positive. The questions below can also be asked.

- Have these symptoms been present since preschool or the early school years?
- Do the symptoms cause impairment in two or more settings (e.g. school and home)?

If the answer to the last two questions is 'yes' and the child has at least six positive inattention or six positive hyperactive/impulsive symptoms, then a diagnosis of ADHD is likely.

Alternatively, a questionnaire based on the American Psychiatric Association criteria may be downloaded online (www.askdrjones.com/wp-content/uploads/2006/07/ADHD_Screening-Significant_Other.pdf) and given to a parent or carer to complete. Again, only symptoms with scores of 2 or above should be considered positive. A screening questionnaire designed for adults to report on their own symptoms is also available (www.med.nyu.edu/psych/assets/adhd_screen18.pdf).

The symptoms of ADHD need to be placed within the family context. Parents who are under duress may sometimes over report problems. An inconsistent and disorganised family environment may impair the child's functioning. On the other hand, disorganisation at home may be a marker of familial ADHD. The family situation may already be well known to the GP. If not, it is important to at least ask the parents or caregivers if there are pressures at home, and how they are managing. Emotional symptoms should also be screened. The questions below can be used as a guide.

- Does the family have a collaborative relationship with the school in assessing and supporting the child's problems?
- Would the family be assisted by access to financial benefits, respite care or family support services?
- Does the child worry a lot more about things than other children of his or her age?
- Does the child often complain of minor physical complaints such as headache, abdominal pain or tiredness?
- Does the child often seem depressed in mood?
- Has the child lost interest and enthusiasm for activities that he or she used to enjoy?

Vision and hearing should also be tested and growth parameters assessed by the GP.

Treatment Medication

First-line treatment for children of a school age and above remains either methylphenidate in an immediate-release form (Attenta, Ritalin 10) or dexamphetamine as a short-acting preparation administered two or three times per day, augmented with behaviour management advice for the parents and learning support for the child. A paediatrician or psychiatrist should initiate medication treatment for ADHD. In some States and Territories

(e.g. Queensland), maintenance prescriptions may then be provided by the GP. Children who tolerate and respond well to immediate-release medication may switch to the longer-acting methylphenidate preparations Ritalin LA (eight hours duration of action) or Concerta Extended Release (12 hours duration of action), which remove the need for the medication to be taken during school hours.¹³

The long-term benefits of taking methylphenidate have recently been questioned.¹⁴ After two years' participation in a carefully controlled treatment study,¹⁵ children who had been randomised to receive methylphenidate were doing no better or worse on a range of symptom measures than children who had been randomised to behaviour management and classroom strategies. The findings, in my opinion,

were overinterpreted given there was convergence in treatments received by the participating children in the intervening two years.

Children aged 6 to 18 years who do not tolerate methylphenidate or dexamphetamine as evidenced by persistent appetite suppression, growth suppression, sleep problems, or the worsening of a comorbid condition may be prescribed the nonstimulant medication atomoxetine (Strattera).¹³ This drug differs from methylphenidate and dexamphetamine by having a slower onset of treatment effect (weeks rather than days) and a different side-effect profile characterised by gastrointestinal disturbance and in some cases sedation. Atomoxetine is typically taken once daily. Children and adolescents who have a history of substance abuse or misuse

(other than alcohol) and/ or comorbid motor tics or Tourette's Syndrome and/or comorbid severe anxiety may be prescribed atomoxetine (on the PBS) without first trialling methylphenidate or dexamphetamine (see the full Schedule).¹³

Some clinicians augment methylphenidate or dexamphetamine treatment with clonidine (Catapres) or risperidone (Risperdal) as these agents can be helpful for reducing associated aggressive behaviour and reversing adverse effects on sleep. To avoid rebound hypertension, clonidine must be administered at least twice daily, and tapered gradually if it is to be discontinued. Another safety issue is storage, as clonidine even in a small overdose can be cardiotoxic. This is a particular concern if there are young children in the household. (Note, however,

continued

that ADHD is not a formally recognised indication for clonidine in Australia.) I reserve risperidone for use in complex cases characterised by severe conduct disturbance, autistic features or intellectual disability, as evidence of benefits has centred on these problem areas.

Approximately 65 to 75% of people respond to the first ADHD medication that is trialled. Parent behaviour management and classroom behaviour management strategies do not increase the likelihood of a response unless the child is also anxious. Such strategies do impact on comorbid oppositional defiant behaviours.

Treatments for ADHD that are not available in Australia include a long-acting dexamphetamine preparation Adderall-XR, methylphenidate delivered by skin patch, and specific isomers of methylphenidate marketed as Focalin. Modafinil is another treatment for ADHD that has proven to be effective in initial randomised control trials.¹⁶ Modafinil is not approved in Australia or elsewhere for the treatment of ADHD.

Dietary considerations

Of parents with children with ADHD attending a referral centre in Western Australia, 60% reported use at sometime of dietary restriction or supplementation.¹⁷ It is good practice to ask parents what alternative treatments they may have tried with their children, and to ask about perceived treatment benefits and adverse effects. Dietary factors do not cause ADHD, but in some children food additives nonspecifically increase irritability and sleep problems and significantly worsen ADHD symptoms. Reactive hypoglycaemia may also contribute to irritability. If reactive hypoglycaemia is suspected, it may be countered by protein loading in the morning and the avoidance of sugary breakfast products.

Possibly the most studied dietary supplement for ADHD are the omega-3 polyunsaturated fatty acids. A review

identified five randomised placebo control trials of omega-3 supplement and concluded that the results were equivocal.¹⁸

Other therapies

Systematic training of motor co-ordination has been proposed as a treatment for ADHD and related conditions in which a delay in cerebellar development is the main problem.¹⁹ This form of therapy has come in to prominence, delivered by a network of Dore Achievement Centres. To date there have been no controlled trials of motor co-ordination training that focus on patients with ADHD, and claims about benefit for learning problems have been refuted.¹⁹

Electroencephalogram biofeedback therapy has been developed following observation that some children with ADHD have excessive theta (slow wave) and diminished beta (fast wave) activity.²⁰ One study has found a correlation between decreased theta wave activity and improvements in ADHD symptom ratings, but controlled trials have yet to be reported.²⁰

Parents are often willing to invest considerable effort and money in seeking 'alternative' solutions for their child's difficulties. However, parents can obtain a good return on investment through maintaining a good working relationship with their child's teacher and school principal.

Conclusion

Although GPs in Australia do not usually participate in the initiation of medication for the treatment of ADHD, some knowledge about the condition and its management is essential to educate patients and their families, co-ordinate initial management and expedite specialist referral of the patient. In addition to medication, psychological therapy supports the successful management of ADHD by promoting learning support for the child and a positive collaboration

between the parents, the child and the school. MT

Further reading

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A list of references is available on request to the editorial office.

DECLARATION OF INTEREST: Professor Hazell has participated in: speaker's bureau for AstraZeneca; contract research for Celltech; advisory boards, submissions to drug regulatory and funding bodies, contract research, and speaker's bureau for Eli Lilly; advisory board and speaker's bureau for Janssen-Cilag; advisory board for Novartis; speaker's bureau for Pfizer; advisory board for Shire.

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