Overview of Attention deficit hyperactivity disorder (ADHD)

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∨ Abstract

Attention deficit hyperactivity disorder (ADHD) is a complex disorder, which can be seen as a disorder of life time, developing in preschool years and manifesting symptoms throughout the adulthood. ADHD is often chronic with prominent symptoms and impairment spanning into adulthood. ADHD is often associated with co-occurring disorders including disruptive, mood, anxiety, and substance abuse. The diagnosis of ADHD is clinically established by review of symptoms and impairment. The biological underpinning of the disorder is supported by genetic, neuroimaging, neurochemistry and neuropsychological data. Multimodal treatment includes educational, family, and individual support. Psychotherapy alone and in combination with medication is helpful for ADHD and comorbid problems. Pharmacotherapy including stimulants, noradrenergic agents, alpha agonists, and antidepressants plays a fundamental role in the long-term management of ADHD across the lifespan.

∨ Introduction

Hyperactivity has long been part of the human condition. Sir Alexander Crichton describes "mental restlessness" in his book *An inquiry into the nature and origin of mental derangement* written in 1798. ADHD was first clearly described by George Still in 1902 [1]. The terminology used to describe the condition has changed over time and has included: in the DSM-I (1952) "minimal brain dysfunction," in the DSM-II (1968) "hyperkinetic reaction

of childhood," and in the DSM-III (1980) "attention-deficit disorder (ADD) with or without hyperactivity." In 1987 this was changed to ADHD in the DSM-III-R and the DSM-IV in 1994 split the diagnosis into three subtypes, ADHD inattentive type, ADHD hyperactive-impulsive type and ADHD combined type. These terms were kept in the DSM-5 in 2013. Other terms have included "minimal brain damage" used in the 1930s [2].

Attention deficit hyperactivity disorder, ADHD, is a mental disorder in which children are especially inattentive, impulsive or hyperactive. “Inattentive” refers to children who have difficulties focusing and are easily distracted. Overly “impulsive” children act in a way that is extremely rash, inconsiderate, careless or impatient for their age. “Hyperactive” describes children who are restless or constantly fidgeting – for instance, they may not be able to sit still during school lessons, and get up and walk around the classroom a lot instead [3].

Severe ADHD can cause major problems in the life and everyday routine of both the child and their parents and brothers and sisters: Because children with ADHD behave differently than expected, they often cause trouble. They need a lot of attention. They find it more difficult to learn because of their short attention span. ADHD may also be accompanied by other kinds of mental disorders [4].

The number of children being diagnosed with ADHD has increased in recent years. Some people are wary of this development and doubt that ADHD is really that common. They are worried that a lot of children who are diagnosed with ADHD are simply a little overactive, but otherwise healthy. A wrong diagnosis may lead to unnecessary treatment. Being wrongly labelled as mentally ill may also affect a child’s self-esteem. But there are also children and teenagers who actually have ADHD but are not diagnosed with it. This can also have a negative effect, because they may not get treatment that could help them. So, it is very important to take the time to look into things so ADHD can be ruled out or diagnosed [5].

∨ Methodlogy:

Computerized search was performed using following databases; CENTRAL, PUBMED, MEDLINE, and EMBASE. for all published studies concerning Attention deficit hyperactivity disorder (ADHD) up to March, 2017., using the term ‘‘lichen planus’’, and searched PubMed, using the Medical Subject Heading (MeSH) term ‘‘Attention deficit hyperactivity disorder (ADHD)’’ and free-text words such “epidemiology” , “pathogenesis”, Clinical features” and “ treatment”. We restricted our search to only English published articles with human subjects.

∨ Discussion:

Epidemiology

The more restricted diagnosis of hyperkinetic disorder in ICD-10, representing a severe sub-group of DSM-IV-TR combined type ADHD, is naturally less common; prevalence estimates are around 1.5% for boys in the primary school years. Such a wide range in prevalence estimates is unlikely to reflect true differences in the numbers of individuals with ADHD in various populations [6]. ADHD is estimated to affect about 6–7% of people aged 18 and under when diagnosed via the DSM-IV criteria. When diagnosed via the ICD-10 criteria rates in this age group are estimated at 1–2%. Children in North America appear to have a higher rate of ADHD than children in Africa and the Middle East; this is believed to be due to differing methods of diagnosis rather than a difference in underlying frequency [7].

Aetiology

The aetiology of ADHD involves the interplay of multiple genetic and environmental factors. ADHD is viewed as a heterogeneous disorder with different sub-types resulting from different combinations of risk factors acting together. The genetic influences appear to affect the distribution of ADHD symptoms across the whole population and not just in a clinically defined sub-group. No single gene of large effect has been identified in ADHD; rather several DNA variants of small effect –each increasing the susceptibility of ADHD by a small amount – have been associated [8]. A range of factors that adversely affect brain development during perinatal life and early childhood are associated with an increase in the risk of ADHD or attention deficit disorder without hyperactivity. These include maternal smoking [9], alcohol consumption [10] and heroin during pregnancy [11], very low birth weight [12] and fetal hypoxia, brain injury, exposure to toxins such as lead and deficiency of zinc [13]. The influence of dietary factors in ADHD has attracted much public attention: food additives, sugar, colourings and 'E' numbers are often regarded as causes of ADHD, and elimination and supplementation diets are widely used, often without professional advice [14]. Disrupted and discordant relationships are more common in the families of young people with ADHD. Discordant family relationships, however, may be as much a consequence of living with a child with ADHD as a risk for the disorder itself [15].

Pathophysiology

Current models of ADHD suggest that it is associated with functional impairments in some of the brain's neurotransmitter systems, particularly those involving dopamine and norepinephrine [16]. (Figure 1)

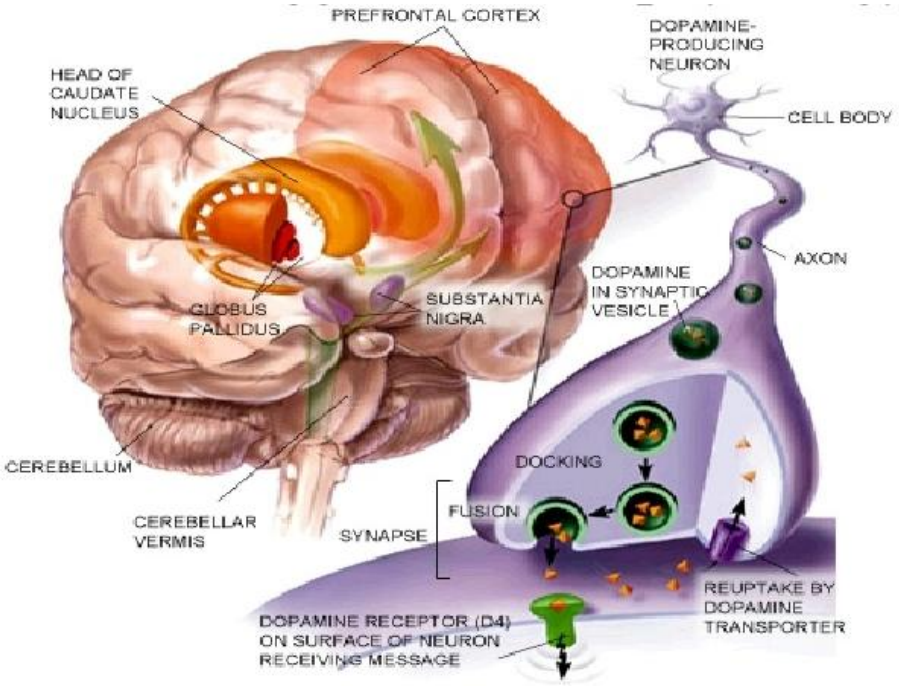

Figure 1: Pathophysiology of ADHD
Source: https://www.slideshare.net/psjensenmd/mta

The dopamine and norepinephrine pathways that originate in the ventral tegmental area and locus coeruleus project to diverse regions of the brain and govern a variety of cognitive processes. The dopamine pathways and norepinephrine pathways which project to the prefrontal cortex and striatum are directly responsible for modulating executive function (cognitive control of behavior), motivation, reward perception, and motor function; these pathways are known to play a central role in the pathophysiology of ADHD. Larger models of ADHD with additional pathways have been proposed [17].

Diagnosis and symptoms

The DSM criteria break down symptoms into two groups: inattentive and hyperactive-impulsive. Six of the nine symptoms in each section must be present for a 'combined type' diagnosis of ADHD [18]. If there are insufficient symptoms for a combined diagnosis then

predominantly inattentive (ADHD-I) and hyperactive (ADHD-H) diagnoses are available [19]. Additionally, symptoms must be: chronic (present for 6 months), maladaptive, functionally impairing across two or more contexts, inconsistent with developmental level and differentiated from other mental disorders [20].

Symptoms of ADHD-I:

- Be easily distracted, miss details, forget things, and frequently switch from one activity to another
- Have difficulty maintaining focus on one task
- Become bored with a task after only a few minutes, unless doing something enjoyable
- Have difficulty focusing attention on organizing and completing a task or learning something new [21]
- Have trouble completing or turning in homework assignments, often losing things (e.g., pencils, toys, assignments) needed to complete tasks or activities
- Seem to not be listening when spoken to
- Daydream, become easily confused, and move slowly
- Have difficulty processing information as quickly and accurately as others
- Struggle to follow instructions
- Have trouble understanding minute details [22]

Symptoms of ADHD-II:

- Fidget and squirm in their seats
- Talk nonstop
- Dash around, touching or playing with anything and everything in sight
- Have trouble sitting still during dinner, school, doing homework, and story time

- Be constantly in motion
- Have difficulty doing quiet tasks or activities
- Be very impatient
- Blurt out inappropriate comments, show their emotions without restraint, and act without regard for consequences
- Have difficulty waiting for things they want or waiting their turn in games
- Often interrupt conversations or others' activities [23]

Differential diagnosis

Symptoms of ADHD such as low mood and poor self-image, mood swings, and irritability can be confused with dysthymia, cyclothymia or bipolar disorder as well as with borderline personality disorder [24]. Some symptoms that are due to anxiety disorders, antisocial personality disorder, developmental disabilities or mental retardation or the effects of substance abuse such as intoxication and withdrawal can overlap with some ADHD. These disorders can also sometimes occur along with ADHD [25]. Medical conditions which can cause ADHD type symptoms include: hyperthyroidism, seizure disorder, lead toxicity, hearing deficits, hepatic disease, sleep apnea, drug interactions, untreated celiac disease, and head injury [26].

Management

Behavioral therapy

There is good evidence for the use of behavioral therapies in ADHD and they are the recommended first line treatment in those who have mild symptoms or are preschool-aged [27].

Psychological therapies used include: psychoeducational input, behavior therapy, cognitive behavioral therapy (CBT), interpersonal psychotherapy, family therapy, school-based interventions, social skills training, behavioral peer intervention, organization training parent management training, and neurofeedback [28]. Parent training may improve a number of behavioral problems including oppositional and noncompliant behaviours [29]. It is unclear if neurofeedback is useful [30].

Training in social skills, behavioral modification and medication may have some limited beneficial effects. The most important factor in reducing later psychological problems, such as major depression, criminality, school failure, and substance use disorders is formation of friendships with people who are not involved in delinquent activities [31]

Regular physical exercise, particularly aerobic exercise, is an effective add-on treatment for ADHD in children and adults, particularly when combined with stimulant medication, although the best intensity and type of aerobic exercise for improving symptoms are not currently known. In particular, the long-term effects of regular aerobic exercise in ADHD individuals include better behavior and motor abilities, improved executive functions (including attention, inhibitory control, and planning, among other cognitive domains), faster information processing speed, and better memory [32].

Medication

Stimulant medications are the pharmaceutical treatment of choice. They have at least some effect on symptoms in the short term in about 80% of people. Methylphenidate appears to improve symptoms as reported by teachers and parents. Stimulants may also reduce the risk of unintentional injuries in children with ADHD [33]. There are a number of non-stimulant medications, such as atomoxetine, bupropion, guanfacine, and clonidine that may be used as alternatives, or added to stimulant therapy. There are no good studies comparing the various medications; however, they appear more or less equal with respect to side effects. Stimulants appear to improve academic performance while atomoxetine does not. Atomoxetine, due to its lack of addiction liability, may be preferred in those who are at risk of recreational or compulsive stimulant use [34]. There is little evidence on the effects of medication on social behaviors. As of June 2015, the long-term effects of ADHD medication have yet to be fully

determined. Magnetic resonance imagingstudies suggest that long-term treatment with amphetamine or methylphenidate decreases abnormalities in brain structure and function found in subjects with ADHD [35].

Guidelines on when to use medications vary by country, with the United Kingdom's National Institute for Health and Care Excellence recommending use for children only in severe cases, though for adults medication is a first-line treatment, while most United States guidelines recommend medications in most age groups. Medications are not recommended for preschool children. Underdosing of stimulants may occur and result in a lack of response or later loss of effectiveness. This is particularly common in adolescents and adults as approved dosing is based on school-aged children, causing some practitioners to use weight based or benefit based off-label dosing instead [36].

While stimulants and atomoxetine are usually safe, there are side-effects and contraindications to their use. A large overdose on ADHD stimulants is commonly associated with symptoms such as stimulant psychosis and mania; although very rare, at therapeutic doses these events appear to occur in approximately 0.1% of individuals within the first several weeks after starting amphetamine or methylphenidate therapy. Administration of an antipsychotic medication has been found to effectively resolve the symptoms of acute amphetamine psychosis [37]. Regular monitoring has been recommended in those on long-term treatment. Stimulant therapy should be stopped periodically to assess continuing need for medication, decrease possible growth delay, and reduce tolerance. Long-term misuse of stimulant medications at doses above the therapeutic range for ADHD treatment is associated with addiction and dependence. Untreated ADHD, however, is also associated with elevated risk of substance use disorders and conduct disorders. The use of stimulants appears to either reduce this risk or have no effect on it [38].

Diet

Dietary modifications may be of benefit to a small proportion of children with ADHD. A third of children with ADHD see some improvement in symptoms with free fatty acid supplementation or decreased eating of artificial food coloring. These benefits may be limited to children with food sensitivities or those who are simultaneously being treated with ADHD medications [39]. The use of a gluten-free diet as standard ADHD treatment is discouraged. Iron, magnesium and iodine may also have an effect on ADHD symptoms. There is a small amount of evidence that lower tissue zinc levels may be associated with ADHD. In the absence of a demonstrated zinc deficiency (which is rare outside of developing countries), zinc supplementation is not recommended as treatment for ADHD. However, zinc supplementation may reduce the minimum effective dose of amphetamine when it is used with amphetamine for the treatment of ADHD. There is evidence of a modest benefit of omega 3 fatty acid supplementation, but it is not recommended in place of traditional medication [40].

v Conclusion

Psychosocial interventions such as educational remediation, structure/routine, and cognitive-behavioral approaches should be considered in the management of ADHD. Contemporary work exhibiting improves outcomes associated with specific cognitive therapies in adults with ADHD. An extensive literature supports the effectiveness of pharmacotherapy not only for the core behavioral symptoms of ADHD but also improvement in linked impairments. Similarities between pediatric and adult groups in the presentation, characteristics, neurobiology, and treatment response of ADHD support the continuity of the disorder across the lifespan.

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