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CURRENT PERSPECTIVES

Overlapping dimensions of autism spectrum disorder and attention-deficit/hyperactivity disorder

Dimensões sobreponíveis da perturbação do espetro do autismo e perturbação de défice de atenção e hiperatividade

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ABSTRACT

This article provides a comprehensive review of the overlap between autism spectrum disorder and attention-deficit/hyperactivity disorder. It also examines the challenges that these overlaps pose in making accurate differential diagnoses and developing effective treatments.

Keywords: attention; attention-deficit/hyperactivity disorder; autism spectrum disorder; executive function; social challenge

RESUMO

Este artigo faz uma revisão das sobreposição entre perturbação do espetro do autismo e perturbação de défice de atenção e hiperatividade. São também discutidos os desafios que esta sobreposição coloca ao diagnóstico diferencial e ao desenvolvimento de abordagens terapêuticas efetivas.

Palavras-chave: atenção; desafio social; função executiva; perturbação de défice de atenção e hiperatividade; perturbação do espetro do autismo

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INTRODUCTION

Autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) are distinct neurodevelopmental conditions that are increasing in prevalence and often co-occur. These disorders typically emerge in childhood and impact children's developmental trajectories, albeit in different ways.[1]

ASD is characterized by persistent challenges in social interaction and communication in a variety of settings, coupled with restricted and repetitive behaviors or interests. Unique motor or verbal behaviors, such as stereotypies, echolalia, and idiosyncratic speech, may also be observed in these children.[1,2] Conversely, ADHD is characterized by marked inattention and/or hyperactivity and impulsivity that manifest before the age of 12, are evident in multiple contexts, and cannot be attributed to another disorder.[1]

Prior to the release of the Diagnostic and Statistical Manual for Mental Disorders, Fifth Edition (DSM-5) in 2013, clinicians struggled to diagnose ADHD in the presence of ASD. The prevailing assumption was that any evidence of inattention and/or hyperactivity-impulsivity was secondary to ASD, precluding a concurrent ADHD diagnosis.[3]

With the removal of this exclusionary criterion in the DSM-5, a substantial body of research has emerged in recent years exploring the complex interplay between ADHD, ASD, and their co-occurrence.[3]

It is now widely accepted that individuals with ASD are at increased risk for other mental health conditions, with estimates ranging from two to four times the prevalence of neurotypical individuals. Notably, 50-70% of individuals diagnosed with ASD also have comorbid ADHD.[2] Conversely, consistent evidence suggests that approximately 1 in 8 children diagnosed with ADHD exhibit symptoms of ASD, as shown in a comprehensive epidemiologic study of ADHD in which 13% of participants received a concurrent diagnosis of ASD.[4,5]

This significant overlap between ADHD and ASD presents significant challenges for clinicians and requires careful consideration in both differential diagnosis and treatment approaches.

OVERLAPPING ETIOLOGY AND CLINICAL FEATURES

ADHD and ASD are both neurodevelopmental disorders that affect movement, language, memory, social skills, and concentration. Although studies suggest that they often co-occur, the reasons for this overlap remain unclear. Both disorders are more prevalent in boys, and although they can persist into adulthood, their co-occurrence is less frequently observed in adults. ASD is generally considered a lifelong condition, whereas long-term studies suggest that ADHD symptoms persist into adulthood in approximately one-third to two-thirds of affected children.[6,7]

Regarding pathophysiology, despite the current lack of a clear causal relationship, both disorders exhibit high heritability, with genetic factors contributing to approximately 70-80% of both phenotypes.[8] In addition, if one twin in a pair has ASD, there is a significantly increased likelihood that the unaffected twin will exhibit symptoms of ADHD.[9] This collective evidence has led to speculation about shared genetic heritability.

Although specific genetic variations associated with these disorders have not yet been identified, ongoing research has revealed an increase in rare copy number variations at similar loci in individuals with ADHD, ASD, intellectual disability, and schizophrenia. These findings provide initial insights into common genetic pathways underlying these disorders.[9]

Neuroimaging studies show minimal overlap between individuals with ADHD and those with ASD, particularly in resting-state connectivity and functional network activation. However, methodological limitations likely contribute significantly to the inconsistency of these findings.[10–12]

Several studies, supported by meta-analyses, suggest that children with ADHD and those with ASD exhibiting ADHD symptoms (but not ASD alone) display widespread dysconnectivity in the precuneus, a node within the default mode network associated with mind-wandering. These findings suggest a common neural abnormality related to the impact of ADHD symptoms, independent of a comorbid ASD diagnosis.[11–13] This highlights the need for further research in this area.

Regarding clinical features, attention deficit is a shared feature of both disorders.

Cognitive processes related to attention can be divided into three functionally independent systems: alerting, orienting, and executive attention. Alerting attention involves establishing and maintaining an optimal state of alertness to process high-priority signals. Orienting attention refers to the ability to focus on sensory input, including disengaging from a stimulus, shifting focus, and reorienting to a new stimulus. Executive attention refers to the top-down regulation of attention, which is responsible for monitoring and resolving conflicts.[14]

Children with ASD exhibit a distinct attention profile characterized by impaired disengagement and orienting of attention, overly focused and narrowed attention, and a reduced ability to filter out distractions. Several researchers have suggested that these atypical attention patterns in children with ASD play a significant role in their cognitive and behavioral impairments. Overfocused attention impairs the perception and integration of complex stimuli and the recognition of relationships between stimuli, thereby weakening central coherence. In addition, difficulties in disengagement can lead to atypical levels of arousal, placing strain on the resources of executive functions required for arousal regulation. These atypical arousal levels may, in turn, lead to reduced attention to social information as a strategy to mitigate overarousal. Additionally, impaired orienting attention may contribute to deficits in joint attention, a critical component of social development.[2,6]

Children with ADHD often have difficulty concentrating on a single task and are easily distracted in their daily activities. Completing one task before starting another is challenging, and sitting still can be physically difficult for them. As a result, they often avoid tasks

that require sustained mental effort and often lose important items. These symptoms have a significant impact on their school, work, and social performance. Interestingly, some children with ADHD may exhibit hyperfocus on certain topics or activities. While hyperfocus can have positive aspects, it can also hinder their ability to shift attention to other activities when needed.[1,3]

Social challenges are a core feature of ASD and critical to its diagnosis. While social deficits are not a required criterion for the diagnosis of ADHD, they are implicit in several diagnostic criteria, such as 'often has difficulty waiting in line'. Parents often report that these deficits contribute to the social difficulties experienced by children with ADHD. These challenges may be primarily due to impulsivity or hyperactivity, but may also be indicative of broader social dysfunction.[7]

Both disorders are characterized by difficulties in forming reciprocal friendships. Children with ADHD typically have intact social knowledge but struggle with social interactions, reflecting a performance deficit. In contrast, children with ASD often face knowledge deficits and tend to respond more effectively to social skills training.

Social challenges in ASD appear to stem from a lack of positive social behaviors, such as eye contact and social approach. Conversely, individuals with ADHD often exhibit negative behaviors, such as interrupting and intruding in conversations. These differences highlight the different nature of social impairment in the two conditions.[1,2,6]

Finally, it is important to consider the effects on executive function. This term refers to a range of mental processes, including inhibition, cognitive flexibility, planning, working memory, and concept formation. Both ADHD and ASD have been extensively studied in relation to executive functioning, and deficits have been consistently found when compared to typically developing children of the same age and intelligence quotient. Specifically, individuals with ADHD often struggle with inhibition (the ability to suppress impulsive responses) and planning/problem solving. In contrast, individuals with ASD tend to have difficulty with cognitive flexibility, which involves quickly adapting and shifting between different perspectives. Impairment of executive function is generally more pronounced in ADHD than in ASD. Notably, individuals with ADHD show limited improvement in executive functioning with age.[1,6]

1. DIAGNOSTIC CHALLENGES

As mentioned above, ADHD and ASD share overlapping features, which makes distinguishing between the two disorders particularly challenging. Currently, there is no specific questionnaire, diagnostic test, or standardized observational tool explicitly designed to differentiate ADHD from ASD. This raises the question of whether such a distinction is both feasible and practical, and whether it provides meaningful value to parents or the child. A significant proportion of children display characteristics of both disorders and meet diagnostic criteria for one or both. The prevailing approach is to focus on identifying the most prominent symptoms that cause the most distress or functional impairment, regardless of the specific disorder. In cases where symptoms are more consistent with ASD, it is legitimate to consider whether an additional diagnosis of ADHD would provide any added benefit.[1,6]

Some authors argue that intervention for ADHD symptoms is warranted only when these symptoms cause significant distress or impairment in daily life. Conversely, the same principle applies to ASD symptoms. Although not a definitive rule, in cases of a combined diagnosis, clinicians typically explore whether the child's developmental difficulties are best understood from an "ADHD perspective," an "ASD perspective," or a combination of the two. This assessment often includes a semi-structured developmental interview to identify early 'red flags' that may suggest either ASD or ADHD, as well as a DSM-based interview that focuses on current symptoms.[6]

Common early signs and risk factors shared by both ADHD and ASD that complicate the differential diagnosis include complications during pregnancy and childbirth, prematurity, low birth weight, and low Apgar scores. Self-regulation problems are also frequently observed, such as excessive crying, increased excitability or irritability, difficulty calming or being reassured, and challenges with eating and sleeping routines. In addition, a hyperextended posture when being held and delayed motor and language development are characteristic of both disorders. Difficulties in social interaction with peers often become apparent in the toddler and preschool years.[6,15,16]

Early developmental signs (up to the age of four) that are more characteristic of ASD than ADHD include deficits in social development, such as delayed or reduced smiling, limited use of social gestures or 'social referencing', disinterest in social games such as peek-a-boo or cuddling, lack of interest in social contact, minimal baby talk, and limited response to one's own name. Children with ASD also often exhibit atypical responses to sensory stimuli, along with stereotyped or repetitive behaviors, limited interests, and a preference for solitary play. While young children with ASD typically have lower activity levels, increased activity levels similar to those seen in children with ADHD may emerge by the age of two to three years.

In contrast, less is known about the early precursors of ADHD compared to ASD, especially those that are specifically indicative of ADHD.[6,15,16]

2. TREATMENT CONSIDERATIONS

Well-studied and effective interventions are available for ASD and ADHD, with approaches tailored to the child's age and developmental stage. For school-aged children with ASD, interventions typically focus on the acquisition of social, adaptive, and academic skills. With the transition to adulthood, the focus shifts to developing vocational and

adaptive life skills for comprehensive ASD management. For school-aged children with ADHD, effective interventions often include organizational strategies and contingency management training for parents and teachers to address behavioral and academic challenges. In adolescence and adulthood, cognitive behavioral therapy (CBT) has been shown to be an effective approach to managing ADHD-related difficulties.[17,18]

Consensus guidelines advise against the routine use of medication to treat core symptoms of ASD. However, stimulants, atomoxetine, and guanfacine are recommended for managing ADHD symptoms in people with ASD.[19] Methylphenidate may reduce hyperactivity and impulsivity in children with ASD, although it has no effect on the core symptoms of ASD.[20] While methylphenidate is effective in treating ADHD symptoms in ASD, studies report smaller effect sizes compared to its use in individuals with ADHD alone. In addition, the use of methylphenidate in individuals with ASD is associated with a higher rate of side effects, including social withdrawal, depression, and irritability. Despite these challenges, stimulants remain the primary treatment option for ADHD symptoms in ASD.[13,21]

Although some evidence suggests that adding psychosocial interventions to medication may not provide additional benefit, most professional guidelines advocate a combined approach when treating ADHD in the context of ASD.[1,18] Social skills training should be recommended for children and adolescents with ASD, according to current guidelines.[18] However, its effectiveness in children and adolescents with ADHD remains unclear. Furthermore, the effects of parent training on children with ASD appear to be influenced by the presence of ADHD, with observed effects being more pronounced in children without ADHD.[1,18]

Adherence to a carefully planned diet is essential for children with ASD, as sensory food restrictions can lead to nutritional deficits. Conversely, loss of appetite is a common side effect of stimulant medications used to treat ADHD [6]. Future research is required to explore the potential impact of diet, exercise, and digital health interventions on the management of these conditions.

CONCLUSIONS

Several models have attempted to explain the comorbidity of psychiatric disorders. Current evidence suggests that ASD and ADHD are related but sufficiently distinct to be considered separate entities. However, the true implications of a dual diagnosis raise questions that lack clear or definitive answers.

Nevertheless, the authors advocate for the exploration of transdiagnostic and more dimensional approaches that may clarify the etiologic overlap, shared impairments, and outcomes of these conditions. Over the past two decades, research interest in ASD, ADHD, and their comorbid presentation has grown significantly. While substantial progress has been made in understanding ASD and ADHD as individual disorders, the study of their comorbidity remains comparatively underexplored. Given the increasing prevalence of both disorders, unraveling the complexities of their co-occurrence is a critical priority for future researchers and clinicians.

Optimal treatment should prioritize a comprehensive understanding of the child's profile, addressing core symptoms, sensory processing, cognitive characteristics, emotional and behavioral challenges, self-regulation, physical health, environmental factors (both protective and risk-related), and adaptive functioning. This holistic approach not only enables a deeper understanding of the child's strengths and challenges to guide future interventions, but also enhances the ability to identify additional issues that may extend beyond ADHD or ASD.

AUTHORSHIP

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