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REVIEW ARTICLE

Differential diagnosis between autism spectrum disorder and other developmental disorders with emphasis on the preschool period

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Abstract

Background Neurodevelopmental disorders are a heterogeneous group of conditions that manifest as delays or deviations in the acquisition of expected developmental milestones and behavioral changes. Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in communication and social interaction and by repetitive and restricted patterns of behavior, interests and activities. The aim of this review is to discuss the clinical features of the differential diagnoses of ASD that are prevalent among preschoolers, focusing on their similarities and disparities.

Data sources The international medical literature search was conducted using PubMed and was revised regarding the subject using single and/or combined keywords as follows: differential diagnosis, preschoolers, diagnostic challenge, attention deficit hyperactivity disorder, intellectual disability, high abilities/giftedness, childhood apraxia of speech, social communication disorder, Landau–Kleffner syndrome, stereotyped movement disorder and excessive screen time.

Results We describe conditions commonly found in clinical practice, taking ASD as a reference. We addressed converging and divergent aspects of behavior, cognition, communication, language, speech, socialization, and stereotypes for the diagnosis of ASD and other disorders identified as potential differential or comorbid diagnoses.

Conclusions The ranking and characterization of symptoms appear to be essential for better understanding the underlying common ground between children with developmental disorders and children with ASD, thus properly diagnosing and directing social, professional, or medication interventions. This detailed discussion adds to the literature since, although ASD differential diagnoses are frequently mentioned and discussed in textbooks and journal articles, they rarely occupy a prominent place as we aimed herein.

Keywords Autism spectrum disorder · Clinical features · Differential diagnosis · Neurodevelopmental disorders · Preschool

Introduction

Neurodevelopmental disorders are a heterogeneous group of conditions characterized by delays or deviations in the acquisition of expected developmental milestones and behavioral changes. These disorders manifest early during the child's development, in general before the school period, and are characterized by developmental deficits that impair personal, social, academic, and professional functioning [1, 2].

Autism spectrum disorder (ASD) is a developmental disorder that can be comorbid or differentially diagnosed with other disorders. According to the Diagnostic and Statistical Manual of Mental Disorders fifth version (DSM-5) [1], ASD is characterized by deficits in two key domains: (1) deficits in communication and social interaction and (2) repetitive and restricted patterns of behavior, interests and activities. These symptoms are present from early childhood and limit or impair daily functioning. The stage at which the functional impairment becomes evident varies according to the characteristics of the patient and his/her environment. The manifestations of the disorder also vary greatly, depending on the severity of the condition, the level of development,

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and the chronological age. Hence, the term spectrum is used, which encompasses distinct conditions according to the DSM [1].

Studies have demonstrated an increase in the prevalence of ASD in recent years. The reported frequencies of ASD in the population have reached 1% in the United States and in other countries. This prevalence was higher among boys than girls across all locations and years, ranging from 2.6 to 5.2 boys per girl. The estimated prevalence of ASD was 13.4 per 1000 children aged four years in 2010 and ranged from 14.1 to 17.0 in 2014 [3]. It remains unclear whether the higher rates reflect the expansion of the DSM diagnostic criteria, increased awareness, differences in the methodology of the studies, or an actual increase in the frequency of the disorder.

Despite advances in the detection of early signs of ASD, the diagnosis of autism remains a challenge, especially in the preschool age group, when an early diagnosis would allow prompt intervention. Part of the diagnostic challenge is due to the similarities between autism and other developmental disorders at an early age. In children under the age of two years, the diagnostic process should be conducted by a clinician with experience in developmental assessment [4]. Notably, many of the early behaviors linked to ASD overlap with those associated, for example, with language delays and intellectual disability [5, 6]. Even experienced professionals may be uncertain about the clinical diagnosis of ASD in young children, which can also be difficult for families that seek answers and help for their children. Thus, a complete assessment of the child's development comprising several domains is needed, including cognition, language, communication and adaptive functioning, as well as social interaction, communication and play skills, which constitute essential features for a differential diagnosis [7, 8].

There is a paucity of literature on the approach to differential diagnoses in ASD, even though they are frequently mentioned and discussed in textbooks and journal articles on ASD, they rarely occupy a prominent place. Thus, the present review discusses potential differential diagnoses of autism with other neurodevelopmental disorders, focusing on similarities and disparities.

We addressed converging and divergent aspects of behavior, cognition, communication, language, speech, socialization, and stereotypes for the diagnosis of ASD and other disorders identified as potential differential or comorbid diagnoses. The ranking and characterization of symptoms appear to be essential for better understanding the underlying common ground between children with developmental disorders and children with ASD, thus properly diagnosing and directing social, professional, or medication interventions. For this, we reviewed international medical literature regarding the subject using single and/or combined keywords as follows: differential diagnosis, preschoolers, diagnostic challenge, attention deficit hyperactivity disorder, intellectual disability, high abilities/giftedness, childhood apraxia of speech, social communication disorder, Landau–Kleffner syndrome, stereotyped movement disorder, and excessive screen time. The literature search was conducted using PubMed. We discussed each of these topics following a sequence including definition, epidemiology, clinical characteristics, and ASD interfaces with similarities and disparities, and then we addressed general interventions.

According to the neurodevelopmental disorders listed by DSM-5, we chose these topics, which present with overlapping symptoms and clinical signs of ASD. Therefore, we excluded specific learning disorders, tic disorders, developmental coordination disorders, and other communication disorders. In addition to the neurodevelopmental symptoms, we added Landau–Kleffner syndrome, high abilities/giftedness and excessive screen time as they present with symptoms that may overlap with autism symptoms. These conditions are discussed in the supplementary materials (Supplementary conditions).

Attention deficit hyperactivity disorder

Attention deficit hyperactivity disorder (ADHD) is defined as the presence of inappropriate levels of inattention, hyperactivity, and impulsivity in two or more settings that begin before the age of 12 and that cannot be explained by another condition [1]. Studies of clinical samples have shown a prevalence of 6% of ADHD in preschool children [9]. The diagnosis of ADHD in the preschool age group is challenging because of the lack of knowledge about tolerable levels (normal range) of hyperactivity and impulsivity in preschoolers.

ADHD and ASD can share common clinical features that may have clinical onset presenting simultaneously either as successively, a fact that sometimes makes it difficult to differentiate between these neurodevelopmental entities [1, 10, 11]. Therefore, the two disorders can either represent comorbid or differential diagnoses [1]. Unlike ASD patients, patients with ADHD are interested in multiple activities and are easily distracted, being unable to focus on one activity for long periods of time. In addition, these patients have difficulties in playing quietly, with routines and rules. These features can help in the differential diagnosis between the two [10, 12, 13], albeit previous discussions have focused on the similarities between them in terms of social behavior, communication, and sensory processing [10, 12, 14].

Social deficits manifest differently in ASD and ADHD. The existing social issues in children with ASD are a feature of the disorder, compromising typical behaviors such as social approach and eye contact [15]. Conversely, social impairment is not clearly established as a diagnostic criterion of ADHD, even though deficits in this

area can be found in children with ADHD with signs and symptoms of hyperactivity/impulsivity, such as being unable to play or engage in leisure activities calmly, waiting for their turn, intruding, or interrupting games [1, 16]. According to Connor, the severity of symptoms in preschool children is an indicator of ADHD, as children who show early symptoms of hyperactive/impulsive behavior and/or inattention that are clearly over what is expected for age or developmental level are at greater risk of developing the disorder. Other indicators of the presence of ADHD in preschool children would be the duration and persistence of symptoms in all contexts to which the child is exposed [17].

Deficits in communication are common in both ASD and ADHD [14]. In patients with ASD, communication impairment is also part of the preestablished diagnostic criteria. Although changes in communication are frequent in ASD, early language development is very heterogeneous, causing several atypical language and speech profiles [18–20]. Some children with ASD have significant language delays or deficits, while others show typical early language development but may develop a mild language delay and later recover [19]. Language deficits in preschool children with ASD may range from receptive and/or phonological disorders to impairments in syntax, semantics and pragmatics [21]. Although not part of the ADHD diagnostic criteria, communication impairment is present as a comorbidity [14, 22]. A study found that 22.4% of 303 preschoolers with ADHD evaluated concomitantly had some kind of communication disorder, including phonological disorder, expressive language disorder, communication disorder not otherwise specified, mixed receptive-expressive language disorder, and stuttering [9].

Sensory processing problems affect the responses of children to daily life events [23, 24]. According to Geschwind, more than 90% of children with ASD have sensory processing alterations in any of the different modalities (tactile, oral, auditory, vestibular, and visual systems) [25]. Ghanizadeh conducted a systematic review involving 11 studies that analyzed the sensory profile of preschool and school-aged children with ADHD. They showed that alterations in tactile, auditory and visual processing are more common in children with ADHD than in typically developing children [26].

ADHD and ASD share similar clinical features, such as impaired sensory processing, social skills, and communication. On the other hand, the child with ADHD is interested in multiple activities with difficulty maintaining attention in a single focus, which are characteristics that differ from the child with ASD, who usually have hyperfocus and restricted interests.

Intellectual disability

The essential features of intellectual disability (ID) include deficits in cognitive skills and impairment in daily adaptive functioning when compared to individuals matched for age, gender, and sociocultural factors. These deficits should be recognized as early as possible during the child's development. The term global developmental delay is used in the DSM-5 for children who do not meet the expected milestones of intellectual functioning for their age. This diagnosis is reserved for children under five years of age, whose areas of intellectual functioning and severity of commitment cannot be reliably assessed, since age is a limiting factor for the application of standardized tests [1].

The estimated prevalence of ID ranges from 2% to 3% [27–29]. Its severity is established based on the results of psychometric tests and the child's level of dependence for performing basic daily activities. Committed people exhibit deficits in both verbal and nonverbal domains, although not necessarily to the same extent. Additionally, impairment in at least one of the following domains of adaptive functioning must be present to meet the definition of ID, according to the DSM-5: conceptual, social and/or practical domains.

ID can manifest in various forms and at different ages in pediatric patients. The more severe the disability, the greater the probability that it will manifest and be diagnosed earlier. The child may first show delays in receptive and expressive language and adaptive skills, fine motor deficits, difficulties in problem-solving skills, social immaturity, and behavioral disturbances. Expectations for social skills were found to decrease as the severity of ID increases, which may eventually result in difficulty in identifying or interpreting social cues [1]. Since ID is associated with general deficits in developmental domains, including socialization problems, the differential or concomitant diagnosis with other neurodevelopmental disorders such as autism is of fundamental importance. Furthermore, genes associated with ASD are often the same as those associated with ID [30, 31], validating the phenotypic and genotypic overlap between the two conditions. This scenario becomes even more challenging when the child also has other comorbidities, such as a sensory disorder, deafness or blindness [32], affecting communication and social skills.

Although potentially common to both conditions, specific deficits in social communication have particularly detrimental effects in children with autism. Children with ID (without ASD) have a greater capacity for shared attention, showing and directing attention better, and show more affection, in addition to having the appropriate eye gaze for communication purposes [33, 34]. In a

retrospective study, Osterling et al. compared the development and behavior of 20 infants with a diagnosis of autism, 14 infants with ID and 20 typically developing infants. The authors observed that children with autism and children with ID used fewer gestures, looked less frequently at objects held by other people and engaged in repetitive motor actions more frequently than normally developing infants. The results also indicated that deficits in interaction through gaze and orientation in response to name calling may have higher specificity as markers of ASD in one-year-old patients [35]. These data suggest that careful evaluation of social communication as a tool may have an impact on the differential diagnosis between ASD and ID, since other aspects of development may overlap in the two disorders. According to Steinhausen et al., the profile of children with ASD appears to exhibit specificities linked to behavioral excesses. The authors suggested that autistic children tend to more frequently show disruptive and self-absorbed behavior, in addition to their communication and anxiety disorders, than children with ID [36].

As ID is a common feature in ASD, differential diagnosis can become even more difficult. The prevalence of this association used to be high, reaching 50%–70% [37]; however, studies have demonstrated a decrease to 20%–38% in recent years [38, 39]. These comorbid conditions are related to greater impairment of adaptive skills [40, 41], which increases functional dependence. Furthermore, data from clinical populations suggest that the distribution of the severity of ID among people with ASD is underestimated, with the rate of severe to profound ID being higher among those with associated ASD and ID [42]. Careful assessment of the severity of ID when diagnosing ASD in a person with ID is important. Thurm et al. suggested that the mental age associated with ID should not be less than 18 months, considering that the assessment of certain developmental skills, such as language, is more limited in this range [32]. Thus, the child development specialist team can rely on these data to determine when the observed deficits are attributable to ID and when an additional diagnosis of ASD is warranted.

ASD and ID can commonly present as differential diagnoses or comorbidities, and both are associated with deficits in social skills. Generally, the interaction domain is more preserved in children with ID, which helps in the differential diagnoses between these two conditions.

Childhood apraxia of speech

The term currently recommended by the American Speech-Language-Hearing Association for cases of nonacquired childhood apraxia is "childhood apraxia of speech" [56]. Childhood apraxia of speech (CAS) is defined as a "neurological childhood (pediatric) speech sound disorder in which the precision and consistency of movements underlying speech are impaired in the absence of neuromuscular deficits (e.g., abnormal reflexes, abnormal tone). CAS may occur as a result of known neurological impairment, in association with complex neurobehavioral disorders of known and unknown origin, or as an idiopathic neurogenic speech sound disorder. The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody" [56].

Regarding the prevalence of CAS, the number of cases has increased substantially over the past decade. Current data indicate a prevalence of CAS of 1–2 children per 1000 children aged 4–8 years [57]. When we analyze the association of CAS with other neurodevelopmental conditions, this rate increases to approximately 4%, and specifically in the case of genetic syndromes such as Down syndrome, the percentage can reach 11% [58].

Children with CAS can exhibit great heterogeneity in their speech and language manifestations–receptive and expressive, and differentiation from other speech sound disorders is a complex task. However, there are three diagnostic features that are consistent with deficits in the planning and programming of speech movements: inconsistent errors in consonants and vowels during repeated production of syllables or words, disrupted coarticulatory transitions between sounds and syllables with prolonged and frequent interruptions, and inadequate prosody, especially lexical accent (intonation) [56]. Other characteristics that may be present in these children are delays in language development; expressive language problems such as word confusion and grammatical errors; difficulties in the development of written language; social/pragmatic language problems; gross and fine motor delays; eating disorders; and abnormal sensory perception (hyper or hyposensitivity, especially in the oral region) [56]. Some of the above characteristics, such as speech and language delays, expressive language delay, prosodic alterations, and sensory perceptual problems, are also found in ASD. A study evaluating children diagnosed with ASD who had a good prognosis (all children were diagnosed early, did not have ID, and underwent at least two years of intervention) showed that 60% of these children had moderate or severe language problems and that 21% also had speech problems [59].

Regarding prosodic skills, the literature is unanimous regarding the presence of abnormal prosody in children with ASD and CAS. In children with ASD, these alterations can affect receptive [60, 61], emissive [62], emotional [60, 61] and linguistic prosody. In the case of emissive prosody in children with ASD, alterations occur mainly in phrase accent (intonation, use of excessive melodic variation) and in word accent (excessive accentuation of the stressed syllable or incorrect accentuation) [62]. On the other hand, emissive

prosody is impaired in CAS [56]: difficulties in accentuating the stressed syllable (uniform use of accentuation) are the main findings, i.e., the stressed syllables are not differentiated [63].

Diagnosing CAS in children under the age of three years is challenging for a variety of reasons, including the potential existence of neurodevelopmental disorders or comorbid conditions, the fact that some primary features of CAS are characteristics of speech emergence in typically developing children under the age of three, and behavioral issues (difficulty in obtaining a sufficient speech sample size for diagnosis, either due to inability or refusal to perform activities) [56]. The differential diagnosis of this condition with other neurodevelopmental disorders such as ASD can be even more complex. An interdisciplinary approach (speech therapist, psychologist, neurologist and others) is needed to obtain the most accurate diagnosis among the diverse conditions. If there are any doubts, a provisional diagnostic classification is used, such as "suspicion of CAS" or "not possible to differentiate between CAS and ASD at this time". The child must then be referred for therapeutic follow-up. An accurate diagnosis will be possible by observing the response to the intervention and with advancing age [1, 56].

CAS and ASD share similar clinical presentations, such as language delays, expressive language delay, prosodic alterations, and sensory perceptual problems. It is noteworthy that the child's global language should be evaluated, since there is more significant global impairment in children with ASD and higher impairment in expressive language in children with CAS.

Social communication disorder

In addition to the changes in the diagnostic criteria for autism, the DSM-5 conceptualized social communication disorder (SCD). This disorder is included in the group of communication disorders. An individual with impaired social communication and social interactions, but without restricted and repetitive behaviors or interests, may meet the criteria for social (pragmatic) communication disorder, rather than ASD, as long as ASD is ruled out and symptoms cannot be explained by either ID or general language delays [1].

However, the concept of SCD as a separate entity is still questioned among researchers because of its clinical similarities with other disorders. Norbury reported high rates of SCD associated with other DSM diagnoses and raised doubts concerning the clinical utility of this new diagnosis [64]. Mandy et al. selected 1081 patients aged 4–18 years who were followed up at a specialized clinic for children with social communication deficits and concluded that SCD might be borderline to the autism spectrum. According to the authors, SCD may be useful in identifying patients with autistic traits that are not severe enough for the diagnosis of ASD but who still require support. Young people who met the criteria for SCD in that clinical sample showed high rates of psychopathology (internalizing and externalizing) and social disability, suggesting that this population has substantial needs that must be addressed by care services [65]. Thus, future research will be crucial to assess the clinical and pathophysiological link between these disorders.

Stereotypy and stereotyped movement disorder

According to the DSM-5, stereotyped movement disorder (SMD) is characterized by apparently purposeless repetitive motor behaviors that interfere with social or academic activities and may result in self-injury [1]. Motor stereotypies can be divided into pathological and physiological stereotypies. Motor stereotypies can be divided into pathological and physiological stereotypies. Physiological stereotypies usually start during the early developmental period and often represent a physiological and transitory stage. These stereotypies are common in early childhood, with a maximum age of manifestation of three years, and affect 60% of neurologically typical children, who exhibit some stereotypic movement or behavior between two and five years [66–68].

Physiological stereotyped movements are characterized by an apparently nongoal-directed repetitive motor behavior that does not interfere with daily activities. Since the child's daily routine is rarely affected and stereotyped movements generally do not cause suffering, they cannot be characterized as a disorder. Social isolation and environmental stress are risk factors since fear can alter the individual's physiological state, resulting in an increased frequency of stereotyped behaviors. Lower cognitive functioning is also associated with a higher risk of stereotyped behaviors and a poorer response to interventions, especially when the child is exposed to an adverse rearing environment [1].

Pathological stereotyped movements can be subdivided into stereotyped movement disorder (primary) and stereotyped movements secondary to other neurodevelopmental disorders. The onset of SMD occurs during the early developmental period and cannot be explained by the effect of substance use or by another neurodevelopmental or mental disorder. The stereotyped movements usually last for seconds to minutes and tend to occur in clusters and many times throughout the day [69, 70]. They are often triggered by periods of excitement, activities, stress, fatigue, boredom, or sleep deprivation [71–73]. Primary stereotypies are classified according to the pattern of movement in common behaviors (e.g., rocking, head banging, finger drumming) and two forms with atypical behavior: head nodding and

complex motor movements (e.g., hand and arms flapping/waving) [69].

Stereotyped movements secondary to other neurodevelopmental disorders can occur in ID, genetic syndromes, and ASD [74–76]. In ASD, studies have provided evidence that stereotyped and repetitive behaviors are multifunctional. In addition to providing sensory relief, these movements also permit attention, focus on a tangible object, or avoid demanding tasks [77–80]. Evidence also suggests that motivations for stereotyped and repetitive behaviors can become more complex over time as associations with new social effects and consequences are established [81, 82].

ASD should always be considered when repetitive movements and behaviors are being evaluated. While deficits in social communication and reciprocity are typical manifestations of ASD, they are usually absent in stereotyped movement disorder. Thus, social interactions, social communication, and repetitive and rigid behaviors and interests are distinctive features of ASD. Once the diagnosis of autism is established, stereotyped movements become one of the patient's symptoms, no longer being considered an SMD, except for more severe cases of autism, in which stereotypes can become the focus of treatment [1].

Once again, given this scenario, the diagnostic challenge is to rule out comorbidities or disorders that justify the condition as secondary since the movement alone does not permit this differentiation. Small studies have tried to compare the stereotyped movements of children in the general population with those of autistic children. MacDonald et al. recorded the number and types of repetitive movements in videotaped gaming sessions and found that children with ASD had slightly higher levels of stereotyped behavior than their typically developing peers [83]. Using a similar approach, Smith and Van Houten suggested that children with developmental delays exhibited movements described as odd compared to those without neurodevelopmental impairment [84].

This is still a field that needs to be further explored. The authors who evaluated patients with stereotypies classified as SMD found autistic behaviors in their series. Robinson et al. studied 23 pediatric neuropsychiatry patients with complaints of stereotypies, of which 65% had a final diagnosis of primary complex motor stereotypy. Remarkably, in many of these children, the authors identified ritualistic behaviors, sameness, and restricted interests [73]. Similarly, Valente et al. studied 26 preschool children with repetitive motor movements after excluding secondary causes, including autism. The authors observed that the repetitive movements of the patients were characterized by complex motor stereotypies, often involving the arms, trunk, and mouth, but rarely accompanied by vocalizations. Although the diagnosis of ASD based on the DSM-5 was excluded from the study, some children exhibited autistic traits such as behavioral rigidity, ritualistic or compulsive behavior, and a tendency toward social withdrawal, along with nonspecific stereotypic patterns. Since these features represent the cardinal symptoms of ASD, the challenge of defining the limits between primary and secondary motor stereotypy must be highlighted. Therefore, global assessment determines the definitive diagnosis [85]. Once accurately diagnosed, the next step is ruling out comorbidities. Studies involving children with a primary complex stereotyped movement disorder [70, 86] have demonstrated a low percentage of comorbidities, such as ADHD, tic disorders, developmental coordination disorder, or other neuropsychological problems. In another study with nonautistic motor stereotypy pediatric patients, almost 50% received at least one comorbid diagnosis. Among seven-year-old children, 30% had ADHD, and 18% had tics [68].

All children who have stereotyped movements should be evaluated to better characterize the movements and identify whether they are primary or secondary to other neurodevelopmental disorders, such as autism. Other clinical features may aid in the differential diagnoses of ASD, such as social interactions, social communication, and rigid behaviors and interests. Supplementary Table 1 shows a summary of clinical ASD features and differential diagnoses, and Fig. 1 shows a graphic of ASD diagnostic criteria and differential diagnosis.

Comorbidities

In addition to the differential diagnoses, the prevalence of other developmental disorders as comorbidities in children with ASD is estimated to be high. ADHD, ID, SMD, high abilities and CAS are disorders that may occur both as differential diagnoses and as comorbidities with ASD. Studies have evaluated the prevalence of these symptoms in children with ASD, including ADHD (between 37% and 85%) [140, 141], ID (between 20% and 70%) [37–39], and giftedness (3%) [142]. On the other hand, Landau–Kleffner syndrome (LKS) and SCD are differential diagnoses of ASD.

Interventions

Early intervention by a multidisciplinary team (psychologist and/or occupational therapist and/or speech therapist) will assist both with the differential diagnoses and the improvement of symptoms of all these conditions. However, the interventions available for each of them may vary. Children with ASD are aimed at the acquisition of social, communication, and adaptive skills, consequently promoting behavioral and functional improvements [10, 143]. In preschool children with (or at risk of) ADHD, the main

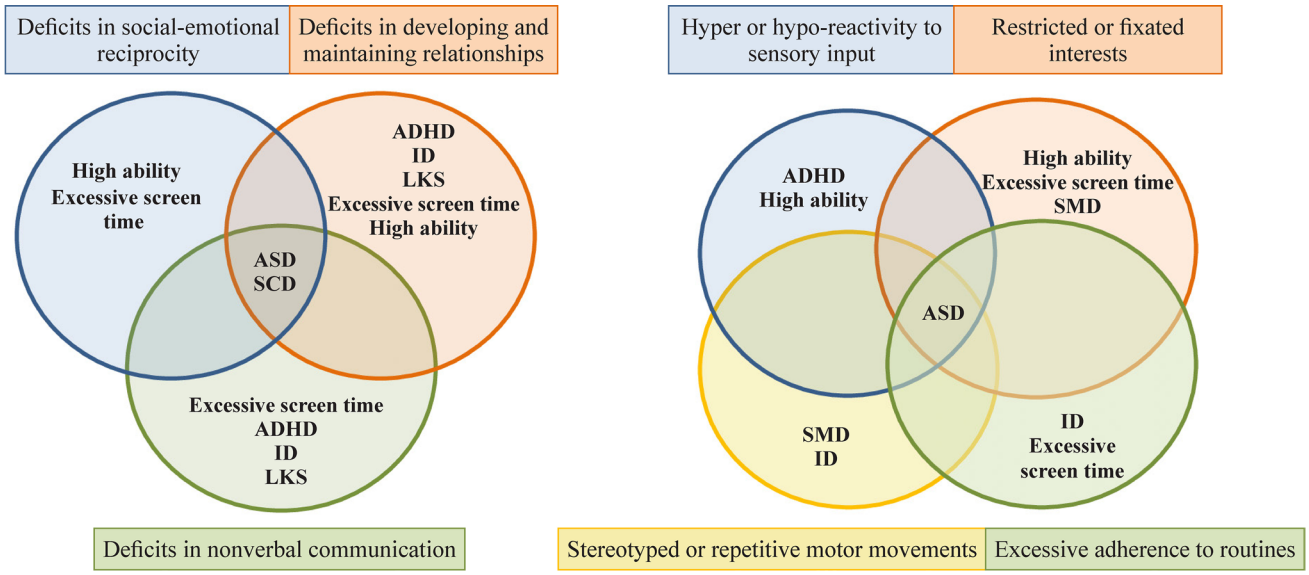

Fig. 1 Autistic spectrum disorder and its differential diagnosis. *ADHD* attention deficit hyperactivity disorder, *ID* intellectual disability, *LKS* Landau–Kleffner syndrome, *ASD* autism spectrum disorder, *SCD* social communication disorder, *SMD* stereotyped movement disorder

treatment consists of the guidance/training of parents in managing their child's behaviors by a psychologist. The remaining therapists will become involved according to the child's specific needs [9, 144]. Children under suspicion of ID should be referred to multidisciplinary treatment and enrolled in a special education program. The attending physician needs to be aware of other associated comorbidities, including ADHD, mood disorders, and aggressive and self-injurious behaviors. Treatment with psychotropic drugs based on the target symptoms can be considered in patients who do not respond to behavioral therapies [145]. Childhood Apraxia of Speech and Social Communication Disorders will mostly benefit from speech therapy.

The goals of electrical status epilepticus during sleep treatment are more complex. They include seizure control, the reduction of electroencephalography abnormalities, and, most importantly, potential improvement or prevention of cognitive impairment. No single treatment protocol exists for this condition. The most commonly used anti-seizure medications are sodium valproate, ethosuximide, sulthiame, levetiracetam, clobazam, and acetazolamide. Steroids are also indicated, and surgical treatment may be considered [146, 147].

Concerning prognosis, although epileptic encephalopathies such as LKS cause developmental regression, the intensity and time to improvement may vary. In general, some degree of delay or deficiency remains, which might be related to the length of time spent between the beginning of symptoms and effective intervention [98]. In addition, the recovery process in LKS is comparatively slow or limited, and the long-term prognosis is inversely related to the age of onset [148].

The treatment of stereotyped movement disorder requires the identification of triggering factors and possible comorbidities with the aim of adequate therapeutic targeting. However, stereotyped movement disorder has a prolonged course in most patients, regardless of therapy, especially in early-onset cases [68]. Last, the recommendations of the American Academy of Pediatrics to avoid or limit the use of screen media for children should be accepted, especially for young children [149].

Limitations

Since there is a paucity in the literature on some topics, such as high abilities/giftedness, childhood apraxia of speech, social communication disorders, stereotyped movement disorder, and excessive screen time, reviewing these themes presented limitations. Psychiatric conditions such as mood and personality disorders are also differential diagnoses with ADS but were not addressed in the review since they are outside the developmental scope.

Conclusions

The clinical manifestations of neurodevelopmental disorders might encompass points of convergence and overlap, sometimes compromising diagnostic accuracy, particularly in the preschool age group. Defining the diagnosis is even more

challenging when these conditions are comorbid or when their natural course is modified by social, professional or pharmacological interventions.

This review aimed to address converging and divergent aspects in the domains of behavior, cognition, communication, language, speech, socialization and stereotyped movements for the diagnosis of ASD and ADHD, ID, high abilities/giftedness, childhood apraxia of speech, social communication disorder, Landau–Kleffner syndrome, stereotyped movement disorder, and excessive screen time, identified as potential differential or comorbid diagnoses. According to the literature data, similarities and disparities were highlighted for each condition based on clinical features to help clinical assistants and researchers. We detailed particular aspects of the signs and symptoms of each condition that are still scarce in the referred literature in more depth. Their ranking and characterization appear to be essential for better understanding the underlying common ground between children with developmental disorders, high abilities/giftedness, Landau–Kleffner syndrome, and excessive screen time and children with ASD. More studies involving this population may help to better define these overlapping conditions.

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Declarations

Ethical approval Not needed.

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