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Review of the literature

Asperger's syndrome: What to consider?

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ABSTRACT

Asperger's syndrome is a neurodevelopmental disorder which is part of the large family of autism spectrum disorders. People with Asperger's syndrome have difficulties in social interactions, verbal and non-verbal communication, and may display behavioural oddities, with stereotypies and limited interests. They show no language delay and their cognitive development is not marked by an overall delay but by specific impairments in certain areas such as the executive functions. The clinical presentations are very heterogeneous, varying according to age and psychiatric comorbidities. Screening, diagnosis and specialized treatment are not made any easier by the diversity of the clinical manifestations. Asperger's syndrome is often diagnosed belatedly, at 11 years of age on average and even in adulthood in some cases. This late diagnosis has a significant impact on the risks of depression and a poor quality of life. However, in adulthood or in adolescence, certain situations, personality traits and cognitive profiles or certain comorbidities should suggest the hypothesis of an Asperger-type autism spectrum disorder. We propose here a review of the clinical situations at different ages of life that could help with the screening and the referral of patients to specialized clinicians for diagnosis and appropriate treatment.

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1. The controversy over the classification of Asperger's syndrome

The nosography of psychiatric disorders is relatively complex, and the successive classifications have not helped to clarify the issue, particularly in child and adolescent psychiatry. However, this evolution reflects new scientific discoveries that have led to the better understanding of certain neurodevelopmental disorders, thereby causing changes to diagnostic criteria.

Asperger's syndrome, which was first described by the Russian psychiatrist Grounia Efimovna Soukhareva [1] and by the German psychiatrist Asperger (1943) [2], who gave his name to it after the work done by Lorna Wing (1981) [3] appeared in the chapter "Pervasive Development Disorders" in DSM-IV alongside autistic disorder [4]. At the time of DSM-IV-TR [5], the large family of pervasive developmental disorders (PDD) included 5 subtypes:

- autistic disorders (including Kanner's childhood autism);
- childhood disintegrative disorder;
- Rett syndrome;
- unspecified developmental disorders (PPD-NOS);

- Asperger's syndrome.

DSM-5 [6] groups these various subtypes into a broader category called "Autistic Spectrum Disorders" (ASD), with the exception of Rett syndrome which has been removed from the classification on the basis of recent genetic data and the fact that neuropediatricians have always considered it to be a progressive developmental encephalopathy. In the new DSM-V approach, a limited dimensional aspect is included, and not just a categorial one, with the notion of a continuum [4]. ASDs encompass a broad spectrum of neurodevelopmental disorders with levels of severity ranging from childhood autism with language impairment to so-called "high-level" autism. Autism is a relatively common disorder: prevalence in the general population is estimated to be between 0.6–1% [7,8]. Different risk factors which may affect early brain development have been identified, of which genetic factors seem to play a predominant role [9] but also certain environmental, and particularly prenatal, factors [10].

To diagnose ASD, a number of two-dimensional criteria must be met:

- "social communication disorders" (where there is a combination of social and communication problems);
- "restricted and repetitive behaviours" (including unusual sensory responses).

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In addition, DSM-V [6] introduces a new diagnostic entity into the “language disorders” category: “social (pragmatic) communication disorder”. The diagnostic criteria for this disorder partly include those for ASDs, since children diagnosed with a social communication disorder have a language pragmatics disorder together with a disorder concerning the “social use of verbal and non-verbal communication”. Nevertheless, the additional presence of obsessive interests and repetitive behaviours precludes the possibility of diagnosing a social communication disorder. The presence of repetitive behaviours is therefore essential for making a differential diagnosis of autism.

The most common criticism of the new definition of ASDs is the narrowness of the new criteria, which may prevent a number of patients from being diagnosed with autism and therefore limit their access to the services they need [11]. The second controversial decision in the eyes of the scientific community, including the American Academy of Child and Adolescent Psychiatry, is the disappearance of the specific diagnostic scheme for Asperger's syndrome. Indeed, some Asperger patients do not meet the ASD criteria and will therefore not receive treatment, while others claim that the new inclusion of Asperger's syndrome in the category of autism spectrum disorders without any distinction has a negative effect on the identity of the persons affected.

However, Asperger's syndrome is a well-defined clinical entity with a rich semiology and relatively characteristic clinical presentations. All over the world, teams working on Asperger's syndrome continue to use this diagnosis as a subtype of ASD with no language delay and a normal or superior IQ [12]. The prevalence of Asperger's syndrome is estimated to be 0.06% in the general population [13], psychiatric comorbidities are frequent and the long-term prognosis is marked by high risk of morbidity and mortality [14].

We propose here a review of the clinical situations at different ages of life that could help with the screening and the referral of patients to specialized clinicians for diagnosis and appropriate treatment. For greater clarity, we shall in this paper use the term Autistic Spectrum Disorder of an Asperger's Syndrome type (ASD-AS).

2. In children and adolescents

2.1. Social isolation and bullying at school

Friendship is an important social experience for children and adolescents, constituting an essential emotional relationship based on stable reciprocal interactions in the context of a close and relatively long-term relationship. Friendship offers children a context in which they can develop and practice their social skills, including concern for others, camaraderie and empathy. Friendship requires both good social adaptability and a good understanding of emotions [15]. However, children with an ASD-AS have difficulties with all of these skills. They will have difficulty initiating play with their peers and will prefer structured activities that have clear and explicit rules requiring little interaction. Therefore, they may have limited experience with their peers because of their lack of social skills and thus struggle to build friendships.

In spite of this, research has shown that children with ASD-AS are interested in relationships, ask themselves questions as to why they are alone and identify the feeling of loneliness at an early stage [16]. Some want to have a friend, but do not realize that this necessarily involves common interests, not deciding on activities alone, not being rigid and letting the friend make choices.

Given the challenge represented by friendship, children with ASD-AS are at greater risk of isolation and relational difficulties with their peers. Several studies have shown that over 40% of children with autism spectrum disorders have been victims of

intimidation and bullying by their peers at school [17]. More generally, children with cognitive and physical impairments have a greater risk of suffering intimidation and social exclusion than their non-disabled peers. In addition, the disabled children report that peer relations and exclusion from social groups are permanent problems throughout their school life [18].

Children with ASD-AS often have difficulty deciphering the subtleties of non-verbal language such as tone of voice, gestures, facial expressions and body language. They make a literal interpretation of speech and do not understand jokes well. They easily become a target of mockery and are more vulnerable than others to rejection by their peers. Their contributions to conversations are often inappropriate or out of phase. In addition, their limited and sometimes unusual interests (trains, science, astronomy, insects, etc.), their stereotypical behaviour, their conversations in the form of monologues spoken with an unnatural intonation tend to exacerbate their difference, increase their isolation and make them more vulnerable to intimidation and bullying. It is not unusual to see children or adolescents with Asperger's syndrome who have developed significant anxiety and depressive symptoms as a result of their relational difficulties, leading in some cases to them dropping out of school. Families are often helpless to cope with these situations of school violence and an emergency withdrawal from school, even though it is a poor solution, becomes necessary.

Yet there are initiatives to integrate Asperger children into ordinary schools which have shown interesting results. However, this active approach can be a major dilemma for parents, since there is a disparity between the child's successful adjustment to the educational requirements of an ordinary school and the difficulties they have with social integration. From a therapeutic point of view, social skills training encompasses a set of strategies aimed at improving interpersonal relationships and understanding social situations by supporting the acquisition of specific skills [19].

2.2. Limited fields of interest and awkwardness-clumsiness

Some children with ASD-AS have the skills to develop symbolic play. However, their games are repetitive and stereotypical, and are not creative. They can play the game of “pretending” with no modification for days on end. Moreover, play is rarely used with the aim of social interaction [20]. Their interests are usually limited, in the sense that they have preoccupations which are abnormal by their intensity or their rigor, focusing on one or more stereotyped interests. Children with ASD-AS are very good at memorizing and are often attracted to specific subjects such as meteorology, technical train data, music, mathematics, mechanics, orientation in space, dinosaurs, or history. These interests may change in content over the years but the basic pattern remains constant. They are sometimes so intense that they prevent accomplishment or they lead to a lack of motivation for other activities, making the youngster appear immature and compromising his social relationships. They often collect stamps, insects, and cards of all kinds [21].

Although these are not part of the diagnostic criteria, children with ASD-AS often have motor coordination disorders. There is, moreover, a diagnostic continuum with children with a specific motor development disorder (dyspraxia) [22]. Because of their motor deficits, young people with ASD-AS have little interest in sports and competitive games. Indeed, their motor movements are clumsy and uncoordinated. Their posture and their gait seem odd. In addition, many of them have difficulty performing activities which require fine motor skills such as writing, tying laces, fastening shirt buttons or drawing. On the sensory level, several children with ASD-AS show sensory hypo- or hypersensitivity, which may lead to difficulties in certain situations where the level of sensory stimulation is high.

2.3. ADHD children and adolescents with significant relational difficulties

Attention deficit disorder with or without hyperactivity disorder (ADHD) is a common neurodevelopmental disorder, considered to be the most frequent psychic disorder in children and adolescents, with a prevalence varying from 3.5 to 5%, depending on the authors [23]. ADHD includes a spectrum of behavioural, cognitive and emotional dysfunctions that revolve around three main symptoms: impulsivity, motor hyperactivity and inattention. It is associated with family, schooling or social impacts, and its evolution is chronic, and sometimes persistent in adulthood.

According to the Larson et al. [24] survey, over two-thirds of ADHD children and adolescents have an associated psychopathological disorder or learning disability. Comorbidities should be systematically investigated; they are frequent and may affect the prognosis. It is thus important to note that neither ICD-10 [25] nor DSM IV-TR [26] accepted the diagnostic association of autistic disorders with ADHD. The distinctive characteristics of inattention and/or hyperactivity/impulsivity sometimes observed in subjects with an ASD must then be directly attributed to the autistic disorder itself, and vice versa. Nevertheless, in everyday practice, strict adherence to this category-related algorithmic rigidity leads to numerous diagnostic but also therapeutic shortcomings for these subjects. Thus, and despite this restriction, many studies have long since shown these co-occurring phenomena. On the basis of these findings, the DSM-V integrated the possibility of a diagnostic co-occurrence into its decision algorithm and minimally included a dimensional perspective.

In addition, several symptoms overlap in ADHD and Asperger's syndrome. Both disorders may lead to a decrease in attention level: e.g. high distractibility for ADHD sufferers and a lack of mental flexibility for ASD-AS subjects. Similarly, for relational difficulties, the explanations vary according to the main diagnosis. ADHD subjects are impulsive, impatient, have trouble waiting for their turn or listening to others and as a result, adjusting their behaviour becomes difficult.

ASD-AS subjects, have a difficulty of treatment of the information of the emotion so they do not respond as it is expected, that can lead to complications in social interactions.

Patients with either disorder often show the special ability to engage their interests very deeply: it is typical for ASD-AS subjects to develop "special interests", while ADHD patients tend to "hyper focus" on subjects that interest them.

In the end, the two types of situations ("overlap of symptoms" or "association of the two disorders") mean that, when diagnosing ADHD with serious relational difficulties, ASD-AS should be sought.

2.4. Heterogeneous cognitive assessment

The heterogeneity of the neurocognitive profile appears to be a constant in children with AS with significant inequalities. The verbal IQ is generally clearly higher than the performance IQ [27]. In the past, these significant disparities concerning standard assessment tools have led some to put forward aberrant interpretations such as "weak central coherence" and incompatibility with true human intelligence. In recent years these assumptions have been seriously questioned through surveys using the standard Wechsler scales and Raven Progressive matrices, an important marker of intelligence which is more suitable for ASD patients [28]. The intelligence of the autistic spectrum is atypical, but also authentic and generally underestimated.

It appears that ASD-AS subjects have deficiencies in their executive functions (planning or mental flexibility), theory of mind and overall information processing, while other strengths are usually observed in the areas of problem solving or fluid intelligence (the

ability to make inferences and understand the relationship between different concepts independently of acquired knowledge). Contrary to popular belief, not all Asperger's are geniuses. There is considerable inter-individual variability (below and above average) in most cognitive tasks [29]. ASD-AS individuals have deficits in tasks that require comprehensive treatment, such as the complex Rey figure. As regards adults, Bowler et al. [30] showed that adults tend to organise information in a singular way. Encoding and storing word lists appear to be particularly characteristic. They cannot organise the recall of words by semantic or associative links, but only by the structure of lists.

2.5. Sensory and perceptual particularities

Unusual sensory experiences are very frequently observed in autistic subjects, with over 90% of them [31] seeming to have sensory peculiarities which, according to certain authors, could explain many of their basic symptoms. Abnormal sensory perceptions could lead to serious anxiety, resulting in repetitive and stereotyped behaviours. Sensory disorders may affect all senses, perceptions may be increased or decreased and there is, furthermore, considerable disparity between different subjects. The high variability and fluctuation of sensory disorders require an informed diagnostic approach [32].

Hypersensitivity is frequently observed in the fields of hearing (noisy environments, vacuum-cleaning, etc.), taste (food selectivity), touch (strongly reacting to the contact of certain types of clothing, to affectionate physical contacts, or to having their hair cut) and smell (body odour). There is also a significant deterioration in movement performance and in proprioceptive and vestibular processing in AS subjects [33]. It is likewise possible to find all these examples as manifestations of hyposensitivity, such as lower pain thresholds (with certain injuries going unnoticed and becoming infected), indifference to temperature (wearing a t-shirt in winter) or vestibular symptoms (rocking or circular movements).

These sensory disorders are considered as normal by the subjects themselves, and awareness of them may sometimes occur at a very late stage, around the age of 20.

According to Ozonoff et al. [34], autistic subjects focus on details rather than the overall picture, on a level which is more conceptual than perceptual. Sensory information is received with a superabundance of simultaneous details, thus leading us to speak of 'Gestalt perception'. Gestalt perception may be invasive and lead to many kinds of deformation in the processing of information, such as fragmented or distorted perception, hyper- or hyposensitivity, fluctuation or sensory agnosia.

Visually, for example, changing a minor detail will cause a change in the entire scene (Gestalt). This may explain the intolerance to small changes observed in people with autism. In terms of hearing, autistics with Gestalt perception will have great difficulty concentrating on auditory stimuli in a noisy environment.

In other words, they have trouble with sorting, as they capture all stimuli indiscriminately. It is thus easy to understand that this operating mode will lead to sensory overload that may quickly become unbearable and give rise to atypical behaviours and avoidance strategies.

3. In adult population

In practice, the diagnosis of ASD-AS in the adult population is difficult and is rarely mentioned in general medicine. There are several obstacles:

- treating physicians lack information about developmental history;

- the lack of knowledge of autistic disorders, but also the lack of reference to international classifications;
- the complexity of symptoms and clinical services;
- entanglement with other psychiatric comorbidities (depression, social anxiety, schizoid or schizotypal personality disorder, chronic tics, emotional lability with aggressiveness, atypical eating disorders, ADHD, dyspraxia).

There is a significant delay in diagnosis and it is not uncommon for the diagnosis to be made in adulthood. One of the possible reasons for this delay can be explained by the fact that ASD-AS individuals have succeeded in partially compensating for their social difficulties. Indeed, they are generally of medium or superior intelligence and are able, to a certain extent, to mask their deficit in social communication skills through stereotyped learning processes of explicit situational rules. Thus, 50 to 80% of people with ASD live independently, nearly 80% have been through higher education, and almost 50% have had intimate interpersonal relationships [35,36]. However, as the social environment becomes more and more complex, this mode of operation is difficult to maintain and becomes increasingly complicated, especially in terms of anxiety and depression.

In addition, the compensatory strategies eventually fail because of their excessive rigidity and do not withstand the significant changes that occur during the course of life (leaving the parental home, starting a professional activity or living in a couple).

The warning signs are most evident in the field of social interactions:

- the resort to university medicine or occupational physicians for failures to understand the relational world and in particular social codes;
- the frequency of the impressions and realities of harassment, particularly at the workplace;
- the incomprehension of humour, implicit meaning, or irony;
- social withdrawal which is incompatible with staying in work, whereas the individual would be intellectually capable of doing so.

Given the lack of specificity of the warning signs in adults, it is important, considering the subject's persistent difficulties in social adaptation and communication with his environment, to also envisage the possibility of an ASD-AS. A number of diagnostic tools are used in practice for screening. The Autism Spectrum Quotient (AQ) [37], the Empathy Quotient (EQ) [38], and the Systemizing Quotient Revised (SQ-R) [39], can be used with high-level autistic subjects as a screening questionnaire, pending confirmation of the diagnosis.

3.1. Asperger's syndrome or schizophrenia?

The differential diagnosis between schizophrenia and Asperger's syndrome is not always easy to make [40]. People with Asperger's syndrome are singular in their style of contact because of their difficulties in expressing their emotions in an appropriate way. The apparent absence of affects and the lack of visual contact and facial expressiveness may give an impression of oddity that can be mistaken for the discordance of schizophrenia. Similarly, the alteration of social interactions may be difficult to distinguish from the withdrawal periods observed in schizophrenia. However, Asperger subjects are more likely to develop conversations when it comes to their favorite subject. Their speech is well organised around precise topics and is not delusional, but it abounds in details and turns into an interminable monologue.

Finally, the impairment of communication skills in Asperger's syndrome, with singular, uninformative spoken language and a

seemingly hermetic discourse dotted with strange neologisms and explanations may appear similar to the thought disorder which is characteristic of schizophrenia.

However, despite the clear distinction between the two disorders, ASD-AS subjects may display transient psychotic episodes, with a sense of depersonalisation and derealisation, which may be accompanied by transient hallucinatory experiences. In the event of repeated occurrence of these episodes, antipsychotic treatment may be justified. In a French study of 122 adult ASD patients, 67 of whom were Asperger's, 12% had a comorbid psychotic disorder (lifetime prevalence) [35]. Interestingly, in this same study, nearly 50% had an anxiety disorder or a mood disorder, 43% had ADHD, 24% had obsessive-compulsive disorder, and 20% had chronic tics.

Concerning schizoid and schizotypal personality disorders, the distinction is equally complex due to overlapping symptoms. It is important to note that people with these two personality disorders may not meet the diagnostic criteria for schizophrenia: in particular, they have no hallucinations or delusions.

In the study by Barneveld et al. [41], 40% of a group of ASD patients also had the criteria for a schizotypal personality disorder. Schematically, schizotypal subjects are described as eccentric, with cognitive distortions and feelings of persecution due to a questionable tendency to "over-interpret" details and social cues such as voice intonation, mimicry, facial expressions and gesticulation. Conversely, Asperger subjects tend to "under-interpret" these same cues.

3.2. Atypical sexuality

In terms of sexuality, the prevalence of homosexuality and bisexuality among young people with ASD appears to be identical to that of other male adolescents and young adults [42]. This suggests that sexuality in individuals with ASD-AS should not be considered to be significantly different from that in subjects with normal development. It is important to remember that sexual and romantic desires exist in people with autism. Although they seek to establish love relationships, they do not know how to go about it and their attitude may be seen as bizarre or disturbing. They lack the social cues that would enable them to understand what can and cannot be done in public, such as undressing, masturbating or talking about sex inappropriately. Their lack of understanding of social situations leads to inappropriate attempts at seduction, which may be perceived as harassment by some.

Moreover, the sexual development of ASD subjects can also be influenced by repetitive, stereotyped behaviours and sensory fascinations [43]. This can lead to compulsive masturbation, possibly with an object, as in fetishism, obsessions with sexual references, or abnormal sexual fears. According to a Dutch study, clinics receiving transgender subjects showed a higher prevalence of ADS subjects [44].

ASD-AS individuals who have not received help to adapt their sexual behaviour so as to be socially acceptable may find themselves in illegal situations with a risk of prosecution and thymic complications.

3.3. At work

In spite of developing linguistic skills in terms of grammar or vocabulary, ASD-AS subjects lack understanding of the pragmatic (implicit or implied) and semantic (irony or metaphor) content, so that communication tends to be very formalised. They are direct and do not seek to avoid offending when reporting mistakes and blunders to their colleagues or supervisors, particularly since they fail to understand the unspoken and implicit aspects of their social relations.

They display a number of weaknesses that are frequently problematic in the professional sphere:

- social naivety leading to a risk of being manipulated, scapegoating by their colleagues and the risk of being a victim of calumny in various forms;
- the refusal to stand up for themselves and compete with others;
- reluctance towards sudden changes: doing an unexpected task can be a source of anxiety.

These weaknesses require precautions to be taken as to the choice of certain occupations and the suitability of work-positions: difficulties with teamwork (preference for positions where they are alone and where they work in total autonomy). Managing a team thus poses problems. Their limited cognitive flexibility may be manifested by certain rituals which are performed in everyday life and which then spill over into the sphere of work. These rituals must be strictly followed (for example, placing pens in a particular place on the desk, starting and finishing the working day at precise times). Any interruption of these rituals simply generates anxiety.

Job interviews can also be complicated for them because they have difficulty putting forward their skills and may behave in a disconcerting manner (not looking the interviewer in the eye, neglecting their dress, a strange way of sitting or laconic, over-frank answers). For these reasons, a first job can be difficult to obtain, even with a university degree. On the other hand, ASD-AS subjects also have many qualities that can be very valuable to their employer: they are usually described as perfectionists and punctual, honest and having great difficulty lying, and possessing logical reasoning faculties and a creative way of thinking.

4. Conclusion

Over and above the arguments about classifications, it appears to clinicians that a group of children, adolescents and young adults stands out within the large family of ASDs because of their particular style of contact, their way of expressing themselves, their centres of interest, but also their social functioning and, to a certain extent, their cognitive abilities. We have mentioned a number of situations which are frequently encountered by practitioners in which it may be helpful to consider Asperger's syndrome in order to better understand the functioning of the patient and to provide specific answers.

Detecting an ASD-AS may lead to better understanding and improved adaptation to the environment: the diagnosis and the self-knowledge resulting from it make it possible to comprehend certain past failures and to be better able to adapt to present situations, and even to recognise the situations to be avoided. Similarly, parents will have a better understanding of the development and the academic and social careers of their child, usually entailing a reduction in their guilt feelings.

The diagnostic procedure is multidisciplinary and is coordinated by a psychiatrist. The diagnosis includes the patient's childhood history and the evolution of the symptomatology at different ages of life. The clinical diagnosis is defined by the use of standardized tools. Screening for associated disorders is essential and is an important prognostic factor. If an ASD-AS is suspected, it is strongly recommended to send the patient to a specialized centre (resource centre on autism, specialized consultations in certain CHUs and medico-psychological centres).

In addition, once the diagnosis has been made, patients can contact dedicated organisations that will, to a certain extent, help them to reduce their isolation and reassure them on the fact that they are not alone.

5. Search strategy and selection criteria

We identified references by searching PubMed and PsycINFO, for articles published from January, 2000, to June 2017. We used the search terms “autism”, “autism spectrum disorder”, “pervasive developmental disorder”, “Asperger syndrome”, and “child”, “adolescent” and “adult”. We identified relevant earlier articles by searching the reference lists of retrieved papers.

Disclosure of interest

The authors declare that they have no competing interest..

References

- [1] Andronikof A, Grounia Efimovna Soukhareva: first description of Asperger's syndrome. *Neuropsychiatr Enfance Adolesc* 2016;64:58–70.
- [2] Asperger H. Die “Autistischen Psychopaten” im Kindesalter. *Archiv Psychiatr Nervenkrankheiten* 1944;117:76–136.
- [3] Wing L. Asperger's syndrome: a clinical account. *Psychol Med* 1981;11:115–29.
- [4] Doernberg E, Hollander E. Neurodevelopmental Disorders (ASD and ADHD): DSM-5, ICD-10, and ICD-11. *CNS Spectr* 2016;21(4):295–9.
- [5] Diagnostic and statistical manual of mental disorders: DSM-IV. Washington, DC: American Psychiatric Association; 1999.
- [6] Diagnostic and statistical manual of mental disorders: DSM-V. Washington, DC: American Psychiatric Association; 2013.
- [7] Baird G, Simonoff E, Pickles A, et al. Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: the Special Needs and Autism Project (SNAP). *Lancet* 2006;368:210–5.
- [8] Baron-Cohen S, Scott FJ, Allison C, et al. Prevalence of autism-spectrum conditions: UK school-based population study. *Br J Psychiatry* 2009;194:500–9.
- [9] Brunsdon VE, Happé F. Exploring the ‘fractionation’ of autism at the cognitive level. *Autism* 2014;18:17–30.
- [10] Guinchat V, Thorsen P, Laurent C, et al. Pre, peri, and neonatal risk factors for autism. *Acta Obstet Gynecol Scand* 2012;91:287–300.
- [11] McPartland JC, Reichow B, Volkma FR. Sensitivity and specificity of proposed DSM-5 diagnostic criteria for autism spectrum disorder. *J Am Acad Child Adolesc Psychiatry* 2012;51(4):368–83.
- [12] Durdiaková J, Warrier V, Baron-Cohen S, et al. Single nucleotide polymorphism rs6716901 in SLC25A12 gene is associated with Asperger syndrome. *Mol Autism* 2014;5:25.
- [13] Fombonne E. What is the prevalence of Asperger disorder? *J Autism Dev Disord* 2001;31:363–4.
- [14] Cassidy S, Bradley P, Robinson J, et al. Suicidal ideation and suicide plans or attempts in adults with Asperger's syndrome attending a specialist diagnostic clinic: a clinical cohort study. *Lancet Psychiatry* 2014;1:142–7.
- [15] Bagwell CL, Newcomb AF, Bukowski WM. Preadolescent friendship and peer rejection as predictors of adult adjustment. *Child Dev* 1998;69:140–53.
- [16] Bauminger N, Kasari C. Loneliness and friendship in high-functioning children with autism. *Child Dev* 2000;71:447–56.
- [17] Zablotzky B, Bradshaw CP, Anderson CM, et al. Risk factors for bullying among children with autism spectrum disorders. *Autism* 2014;18:419–27.
- [18] Van Cleave J, Davis MM. Bullying and peer victimization among children with special health care needs. *Pediatrics* 2006;118(4):e1212–9.
- [19] Baghdadli A, Brisot J, Henry V, et al. Social skills improvement in children with high-functioning autism: a pilot randomized controlled trial. *Eur Child Adolesc Psychiatry* 2013;22:433–42.
- [20] Szatmari P. Asperger's syndrome: diagnosis, treatment, and outcome. *Psychiatr Clin North Am* 1991;14:81–93.
- [21] Happé F. An advanced test of theory of mind: understanding of story characters' thoughts and feeling by able autistic, mentally handicapped, and normal children and adults. *J Autism Dev Disord* 1995;24:129–54.
- [22] Magnat J, Xavier J, Zammouri I, et al. Developmental coordination disorder (DCD): clinical aspects and state of art. *Neuropsychiatr Enfance Adolesc* 2015;63:46–56.
- [23] Polanczyk G, de Lima MS, Horta BL, et al. The worldwide prevalence of ADHD: a systematic review and meta-regression analysis. *Am J Psychiatry* 2007;164(6):942–8.
- [24] Larson K, Russ SA, Khan RS, et al. Patterns of comorbidity, functioning, and service use for US children with ADHD, 2007. *Pediatrics* 2011;127:462–70.
- [25] ICD-10 Organisation mondiale de la santé CIM-10/ICD-10. 10^e révision de la Classification internationale des troubles mentaux et des troubles du comportement, tr. fr. Genève OMS. Paris: Masson; 1993.
- [26] American Psychiatric Association Diagnostic and statistical manual of mental disorders. 4th ed. Washington, DC revised: American Psychiatric Association; 2000.
- [27] Boschi A, Planche P, Hemimou C, et al. From high intellectual potential to Asperger syndrome: evidence for differences and a fundamental overlap-A systematic review. *Front Psychol* 2016;7:1605.
- [28] Mackintosh NJ. IQ and human intelligence. New York (NY): Oxford University Press; 1998.

- [29] Gonzalez-Gadea ML, Tripicchio P, Rattazzi A, et al. Inter-individual cognitive variability in children with Asperger's syndrome. *Front Hum Neurosci* 2014;8:575.
- [30] Bowler DM, Gaigg SB, Gardiner JM, et al. Free recall learning of hierarchically organised lists by adults with Asperger's syndrome: additional evidence for diminished relational processing. *J Autism Dev Disord* 2009;39:589–95.
- [31] Leekam SR, Neito C, Libby SJ, et al. Describing the sensory abnormalities of children and adults with autism. *J Autism Dev Disord* 2001;37:894–910.
- [32] Bogdashina. Sensory perceptual issues in autism and Asperger syndrome. London, UK: Kingsley; 2003.
- [33] Siaperas P, Ring HA, McAllister CJ, et al. Atypical movement performance and sensory integration in Asperger's syndrome. *J Autism Dev Disord* 2012;42(5):718–25.
- [34] Ozonoff S, Strayer DL, McMahon WM, et al. Executive function abilities in autism and Tourette syndrome: an information processing approach. *J Child Psychol Psychiatry* 1994;35(6):1015–32.
- [35] Hofvander B, Delorme R, Chaste P, et al. Psychiatric and psychosocial problems in adults with normal-intelligence autism spectrum disorders. *BMC Psychiatry* 2009;9:35.
- [36] Marriage S, Wolverson A, Marriage K, et al. Autism spectrum disorder grown up: a chart review of adult functioning. *J Can Acad Child Adolesc Psychiatry* 2009;18(4):322–8.
- [37] Baron-Cohen S, Wheelwright S, Skinner R, et al. The autism-spectrum quotient (AQ): evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *J Autism Dev Disord* 2001;31:5–17.
- [38] Baron-Cohen S, Wheelwright S. The empathy quotient: an investigation of adults with Asperger syndrome or high functioning autism, and normal sex differences. *J Autism Dev Disord* 2004;34:163–75.
- [39] Baron-Cohen S, Wheelwright S, Robinson J, et al. The Adult Asperger Assessment (AAA): a diagnostic method. *J Autism Dev Disord* 2005;35:807–19.
- [40] Da Fonseca D, Viellard M, Fakra E, et al. Schizophrénie ou syndrome d'Asperger? *Presse Med* 2008;37:1268–73.
- [41] Barneveld PS, Pieterse J, de Sonnevile L, et al. Overlap of autistic and schizotypal traits in adolescents with Autism Spectrum Disorders. *Schizophr Res* 2011;126:231–6.
- [42] Hellemans H, Roeyers H, Deboutte D, et al. Sexual behavior in male adolescents and young adults with autism spectrum disorder and borderline/mild mental retardation. *Sex Disab* 2010;28:93–104.
- [43] Koller RA. Sexuality and adolescents with autism. *Sex Disab* 2000;18:125–35.
- [44] De Vries AL, Noens IL, Doreleijers TA, et al. Autism spectrum disorders in gender dysphoric children and adolescents. *J Autism Dev Disord* 2010;40(8):930–6.