

The assessment of neuropsychological functioning in adults with autism spectrum disorders – tackling the challenge

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Summary

Assessment of neuropsychological functioning in adults with ASD has been researched for a while now, yet there seems to be no consensus on what the actual profile of impairment in this group of patients is. Conflicting results of various studies may be connected to many factors: heterogeneity of the clinical group, changes in diagnostic criteria, applied tests and assessment methods, trouble with matching healthy controls because of individual differences in neuropsychological functioning. The aim of the following paper is to analyse the selected domains of cognitive functioning in adult ASD individuals. It seems that the most consistent findings in this group are connected to central coherence and cognitive flexibility which in turn affect social functions and repetitive behavioral patterns – two core issues of ASD patients. The implications of those findings for clinical practice and diagnostic approach to adult ASD patients are discussed. Especially in regards to high-functioning ASD individuals whose neuropsychological impairment may not show in a neuropsychological assessment.

autism spectrum disorders, cognitive functioning, neuropsychological assessment

INTRODUCTION

Autism is a neurodevelopmental disorder, which means it is present from early childhood and the symptoms last throughout one's entire life [1]. The term 'neurodevelopmental' also suggests that this disorder is neuropsychological in nature [2]. It encompasses not only the way a person processes social information but also their cognitive functioning, e.g. attention, executive functions or central coherence [3]. According to DSM-5, autism is a broad spectrum of traits and dysfunctions that vary greatly between individuals, especially in adult population [4]. Because

it is a disorder present since early childhood, it evolves and changes in each individual as they age, sometimes making the diagnosis very difficult in adults. Comorbid disorders, including mood disorders, anxiety disorders, substance abuse, or even personality disorders are quite common [5]. All this makes the diagnosis of ASD a very complex process in which a clinician has to differentiate between symptoms of the neurodevelopmental issues and difficulties which arise from another disorders.

Asperger Syndrome, autism spectrum disorder, high functioning autism – the nosology and conceptualisation of this group of neurodevelopmental disorders have evolved from the early descriptions made by Kanner and Asperger in the 1940s to a complex spectrum of difficulties named autism spectrum disorder (ASD) in

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the newest DSM-5 [6]. This has led to many inconsistencies and confusion regarding the symptoms and their manifestation. Even to this day there are problems with conceptual boundaries of what autism spectrum is in adults. Research showed that there is little correlation between ICD 10 and DSM – IV when it comes to criteria overlap and the clinical presentation [7]. Aforementioned issues make assessment based solely on the clinical interview and checklisting the manual's criteria prone to error, causing frequent misdiagnosis. Analysis done by Takara & Kondo shows that autism spectrum disorder is one of the most frequently misdiagnosed conditions. In majority of cases people who suffer from ASD get a diagnosis of schizophrenia or personality disorders [8]. Moreover, the goal is to diagnose at the youngest possible age, because early behavioral interventions, decrease the risk of developing comorbid issues like anxiety disorders or mood disorders [9]. The first symptoms of autism can be seen even before the child reaches third year of life, but most parents tend to ignore the first signs. If the autism is mild or atypical, the person can slip through the diagnostic cracks until adulthood [10].

The aim of the paper is to review the selected domains of the cognitive functioning in adult ASD individuals important for the neuropsychological assessment and diagnosis.

Neuroimaging and EEG

Given the complexity and pitfalls of the ASD diagnosis, the researchers often point toward more objective measures like EEG and neuroimaging as invaluable help in differentiating neurodevelopmental disorders from other issues [11]. Unfortunately, ASD is a very heterogeneous issue which shows in inconsistent results gathered from EEG. Early EEG studies failed to identify any consistent pattern of abnormal neural activity, even though some sleep studies show that up to 61% of ASD patients can have epileptiform discharges in EEG without any medical history of seizures. The problem with EEG research in ASD often lied in the lack of specificity, accuracy and standardized approach to the diagnosis. As of late the quantitative analysis of EEG allows for more precise investiga-

tion but the results still lack specificity required to make a proper diagnosis [12]. Similarly neuroimaging studies don't give a clear answer to what differs an autistic brain from the rest of the population. The review of neuroimaging studies by Anagnostou and Taylor published in 2011 states that great heterogeneity exists within ASD and points to underlying neuroanatomical atypicalities in connectivity [13]. The topic of abnormal connectivity is being further developed in research regarding cerebellar involvement in repetitive, stereotypical behaviors [14]. For example, many genes connected to ASD susceptibility also play important role in cerebellar development [15]. Furthermore, clinical studies of ASD and animal models demonstrate that disruption of connectivity between cerebellum and cortex generates autistic behaviors [16].

Still, the neurophysiological and neuroanatomical markers are not specific to neurodevelopmental disorders, neuropsychological assessment continuously plays the main role in diagnosing ASD in adults and children [17].

Neuropsychological assessment

Intellectual functioning

Before the age of modern psychiatric and psychological diagnosis, people suffering from autism spectrum disorders were often associated with mental retardation or general developmental delay. Nowadays, we understand that connection between intelligence and ASD is far more complex and interesting. In the modern classification ASD is a separate entity from an intellectual disability which is a category that encompasses anyone with a score in IQ tests falling below 2 standard deviations [4]. Prevalence of developmental delays in the ASD group reaches 40%, which means that more than a half of individuals with ASD won't have measurable general developmental delays [18].

Standard IQ testing methods may not necessarily be accurate in the ASD group. The study done for the Special Needs and Autism Project in 2012 argued that communication deficits of even high functioning adult patients with ASD could mask their true intellectual potential. What is even more interesting, Ruthsatz and her colleagues conducted a research on a group of near-

ly half a million people which showed that autistic traits or high functioning ASD are often correlated with achievements in the fields related to subjects like mathematics, engineering or music. There may be a genetic link between autism and gifted families that often produced autistic and/or ingenious children. Although it does not prove the direct causality between intelligence and ASD, it shows how complex this relation may be [19].

Wechsler Adult Intelligence Scale (WAIS) is one of the most commonly used tests of intellectual capabilities for the adults. Research consistently shows unusually uneven intellectual profile of people suffering from ASD [20]. Those individuals achieve significantly better score in the Performance subscale. They are also doing better with abstract tasks rather than connected to social skills. For example, patients with ASD achieve relatively high score in the "Block Design" task which measures spatial reasoning and ability to find patterns in a geometric shape. On the other hand, the "Picture Arrange" and "Comprehension" may show difficulties associated with social skills and functional issues within the right hemisphere. Lower scores in those tasks don't have to be associated with the "Information" and "Vocabulary" tasks scores. High functioning adults with ASD often have good verbal comprehension, general knowledge, and good verbal fluency. There can also be observed lower scores in tasks like "Coding", "Digit spans" and "Arithmetic" that require cognitive flexibility, fast processing and multitasking. One of the newest research on WAIS profile in ASD adults showed that a significant difference occurred in two subtests: "Symbol Search" and "Coding" with control group achieving higher scores in coding, whereas high functioning ASD were better than control in "Symbol Search" [21].

Memory and executive functions

Memory seems to be a multifaceted phenomenon in which individuals with ASD may suffer from impairment in one area, whereas still show strengths in another [22]. For example, adult, verbal individuals with ASD have relative strengths in declarative memory, procedural memory, ability to recognize words and recalling general knowledge. However, those

strengths coexist with impairment in memory for complex social information [23] and episodic memory (memory for personally experienced events). When it comes to verbal memory, individuals with ASD may have a relative impairment in memory for more complex linguistic material. It could be connected to issues with central coherence which require putting together the bigger picture from small pieces. This may in turn interfere with their ability to tell a comprehensive story or sequence of events [24].

Aside from the long-term aspect of memory, a slew of research looked into working memory functions in ASD individuals. Working memory is a domain of executive functions and an ability to sustain information in the state of direct availability during problem solving tasks. While it seems true that people on autism spectrum show superior visual discrimination and "hyper-systemizing" cognitive style [25], the visual working memory shows significant impairment when compared to healthy control [26]. At the same time verbal working memory isn't believed to be impaired in this disorder [27]. It still requires further studies to determine why spatial working memory deficit in ASD patients consistently appears throughout many research. One of possible explanations lies in global working memory processing or connectivity deficit in the ASD brain [28]. Another hypothesis connects visual working memory impairment to repetitive behavioral patterns and issues with executive functions caused by a focused deficit in a prefrontal cortex. It may be so autism spectrum disorder patients don't suffer from working memory issues as much as inability to be flexible and fast in analyzing incoming, complex stimuli which leads to encoding smaller number of details [29].

Working memory is not the only aspect of executive functions (EE) that seems to be impaired in patients with ASD [30]. Unfortunately, the EE include a wide variety of skills and their impairment is not only specific to people with autism. For example, in one research patients showed performance similarities in the Tower of London Test to people with frontal lobe lesions [31]. Despite the fact that EE deficits are well documented in both: adults and children, the scores in tests are not enough to diagnose autism spectrum due to its variable and non-specific nature.

Regardless, people with ASD have a chance to achieve lower scores than the healthy population in tests that measure various EE domains, especially flexibility [32].

It is a widely accepted truth that impairment in executive functions is one of the main issues in autism, however diagnostic problems posed by high functioning adult ASD individuals remain largely unsolved. Most of the participants in studies that focus on executive functions are either children or poorly functioning adults with a history of long psychiatric treatment [33]. Studies with high-functioning participants show mixed results in majority of standardised neuropsychological tests, which makes creating a neuropsychological profile for high-functioning ASD adults difficult [34]. Given that many individuals with ASD suffer from comorbid ADHD, obtaining unified EE tests results in this group may be quite a challenge [35].

Central Coherence

The notion of the central coherence in autism was coined by Utah Frith and her team who focused on ASD performance superiority rather than its shortcomings [36]. According to them, central coherence (CC) is a drive to build gestalt (or global) meaning from details, often at the expense of memory or attention to details [37]. Because persons with autism spectrum are biased to processing tasks at a local level rather than a global level, they tend to focus on the details rather than the overall point or theme of the task. However, this would be a hindrance only in those problems that require strong central coherence (ex. understanding social situations), whereas problems where localised thinking is required would be easier for people with ASD (ex. systematizing) [38]. As with most of findings regarding autism, also CC accounts are conflicting. In simple tasks that integrate color and shape of a single object in a visual search, no difference was found between ASD and healthy control [39]. However, in tasks that require processing more complex stimuli, like Fragmented Picture-Completion Task, bias toward detail-oriented style of thinking is more visible. Despite the fact that ability to build global meaning varies among research, one factor remains fairly consistent – time. Even if the individuals with

ASD reach similar score in tasks that demand strong central coherence, they take more time than healthy controls [40].

Central coherence is a relatively new domain of cognitive functions. Some argue it belongs with executive functions, because it may influence stereotypical, repetitive behaviors seen in ASD [41]. Others claim it to be a separate ability that is only modifying performance on executive function tests. Aside from executive functions it may be linked to poor understanding of social context and spontaneous social reactions [42]. The notion whether among typically developing individuals or mental disorders other than autism central coherence can be subjected to individual differences is yet to be studied.

To the best of our knowledge, there is no normalized CC test, which makes assessment in a clinical setting rather difficult. However, a study done by Kushner in 2009 showed that there are differences between high functioning autistic adults and normal control in performing Rey-Osterrieth Complex Figure Test. There was no such difference in approach to drawing the figure between ASD children and typically developing control (TD). Both groups of children showed bias toward local processing and similar final scores. When it comes to adults, the results are slightly different with adult ASD individuals showing local processing bias and control group shifted toward global processing with similar final scores [43]. It results from learning by typically developing children how to use global thinking, while children from the ASD, as they grow up, do not acquire such skills efficiently. This shows that some neuropsychological tests and tasks can be researched for differences in approach to solving them rather than the performance itself.

CONCLUSIONS

Diagnosis of ASD in adults is challenging due to various factors: comorbid issues, lack of awareness among the clinicians regarding the manifestation of symptoms in the adult population and lack of consistency between DSM-5 and ICD-10 when it comes to the diagnostic criteria. Neuropsychological difficulties present in people with ASD make the neuropsychological test-

ing a viable method used in a diagnostic process. In neuropsychological measurements the ASD is still a heterogeneous disorder in terms of how severe the neuropsychological deficits are. Despite the fact that recent meta-analysis shows that there is a consistent impairment across all domains of executive functions in ASD [44], the type and level of impairment is too different to build an unified profile. Adults with ASD are a clinical group which presents wide variety of functioning impairment which sometimes boils down to problems in social functioning and limited ritual behaviors whereas some patients can't function without psychiatric and psychological support [4]. Especially diagnosing high functioning adults poses a clinical challenge, since their deficits may not be apparent in neuropsychological tests results. This said, in standard neuropsychological tests, it is maybe worth to look and compare how high-functioning ASD individuals approach problem solving and observe their strategies more than what scores they achieve.

Additional way to circumnavigate the diagnostic issues of neurodevelopmental disorders is to create a completely new battery of tests with ecological goals in mind. Tests which capture an essence of cognitive skills in everyday life rather than discriminate between normal vs abnormal performance on abstract tasks [45]. The Autism Diagnostic Observation Schedule—Generic (ADOS-G) is an attempt at creating standardized assessment of everyday social and organizational skills rather than measuring selected neuropsychological functions [46].

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